

 **ACTEX Learning**

**Study Manual for
Exam EA-2F**

Fall 2023 Edition

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An EA Exam



Actuarial & Financial Risk Resource Materials
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Preface

The purpose of this book is to give you all of the information that you will need to take and pass the 2023 EA-2, Segment F exam that will be given in November 2023.

This book is not meant to be a textbook on actuarial mathematics. It is assumed that anyone reading this book already is familiar with the mathematical concepts tested on the EA-1 exam. The text of the book and solutions to exam questions are also written presupposing a test candidate possesses this knowledge (for example, actuarial factors such as $\ddot{a}_n\%$ will be simply given, with no description of the calculation – and it is assumed the reader can match the values provided). Knowledge of these principles is also assumed by the creators of the examination, as noted in the 2023 Examination Program Booklet published by the Joint Board for the Enrollment of Actuaries. This book (and the exam) also assumes candidates have a working knowledge of common commutation functions.

The EA-2, Segment F exam also presupposes knowledge of the topics on the EA-2, Segment L exam, regarding federal pension tax and labor laws that apply to pensions under the Employee Retirement Income Security Act (ERISA).

Those wishing a review of specific actuarial concepts relating to pension plans should consult the book [Pension Mathematics for Actuaries](#), (3rd Edition – 2006) by A.W. Anderson and referenced in the suggested readings located in the Examination Program mentioned above.

If you have not already secured your copy of the 2023 Examination Program Booklet, you should do so immediately. The booklet can be downloaded at the website for the Joint Board Examination program, located at:

<http://www.irs.gov/Tax-Professionals/Enrolled-Actuaries/Joint-Board-Examination-Program>

Past years exams along with answer keys (although, not explanations as to how the answers are determined, why they are correct, and what published laws affect the correct answer) can also be downloaded from this site at no charge to an exam candidate.

Your first step in preparing for the exam should be to become familiar with the design of the exam and the terms used on the test. Test questions are each worth one to five points. The test is four hours in length and the total point value is 160. This means a qualified candidate is expected to take about 1½ minutes per point, and the questions are scored based on the expected length of time a candidate will spend to get that question correct. The exact number of questions is not known and varies from year to year. Over the past several years, the number of questions has ranged from a low of 51 to a high of 60. More questions, of course, means that the individual questions are of lower point values (suggesting they can be performed more quickly) so that the total point value of the exam remains constant.

There is no penalty on the test for incorrect answers, so candidates should make an attempt to answer every question, even if the answer is just a guess. Gauge your time on each question and if you feel you are spending too much time, move on and come back to that question later. The passing score on the exam is not determined prior to the exam being given, nor is it announced once the passing score is later determined. If you simply cannot arrive at an answer without using up an excessive amount of time, it is acceptable to just guess at a question. A correct guess will improve your score and a wrong guess will not hurt it.

You should make yourself familiar with the Conditions Generally Applicable to All Examination Questions listed in the examination program booklet. All of the conditions listed will also apply to any statements or sample questions in this book, unless explicitly stated otherwise.

You should also look over the commutation factors, and the limits and tables page. These pages will be available to you during the examination, but you should become familiar with them and know how and where to quickly find needed items before the exam begins. Because the guide will present some practice questions based on the commutation tables, a copy of those tables are provided at the back of this book.

Suggested Course of Study

The great majority of questions on the exam follow the same pattern: Information is given about a plan, possibly including data taken from the actuarial valuation of one or more specific years, and possibly including information about one or more plan participants. The exam candidate is then asked to determine some other related value, for example, the minimum required funding contribution or maximum deductible contribution the employer can make for the year.

For this reason, this book is designed to teach *funding methods*, rather than just specific facts about such methods. The facts are explained, but in the context of how all of the individual facts work together to create a single coherent method of determining contribution minimums, maximums, and other related data.

It is recommended that you study the chapters in this book as a complete whole in the order that they are presented. Each chapter builds upon and expands the information in previous chapters. For this reason, it is recommended that you not move to the next chapter until you have a full grasp of the previous chapter, including understanding all of the solutions to the review questions and *why* the answers are correct. It is very useful to read the full explanation of the solutions to problems at the end of each chapter, since they contain hints as to what may be slightly changed to produce a different answer if a similar question is asked again on the next exam.

Once you have completed your study of all of the chapters of the book, take the 2018, 2019, 2020, 2021, and 2022 exams provided in this book. Try to take these past exams under the actual exam conditions you will face. Find a quiet area where you will be undisturbed for a full four hours and answer all of the questions in a single timed sitting. Do not have any reference materials other than those made available for the exam (the reference pages in the exam booklet discussed above) and use the calculator that you plan to use when taking the exam so you can become familiar with the quickest way to use it for calculations common on the exam. Make notes on which types of questions seem to take the most of your time, so you can know to skip past these types of questions on the actual exam and move back to them at the end of the exam, after you have finished the questions that you are comfortable in completing in less time.

After you have completed a past exam, read through the entire answer section for that exam, even those questions that you answered correctly, because the solutions are filled with hints about why the question may have been asked in the way that it was, and can prepare you for what similar or dissimilar types of questions you can expect to see on the upcoming exam. The

teaching method of this book focuses on a question and answer approach. I believe that solving actual questions using the funding concepts in the book is a better way to learn the concepts than a simple dry reading of those concepts. Also, for questions that you have missed, go back to the text of this book or the source material (Internal Revenue Code, Treasury regulations and other publications) to study the points that you need to master more fully.

A note on the exam solutions given in this book: The solutions are detailed, and perform the mathematical calculation step by step. Many of the questions and their solutions are repetitive and every single mathematical step is shown on every single question. This has been done to aid the reader in learning through repetition. The goal is to make the concepts in this book and in the exam questions so familiar to you that you will recognize them immediately without having to think about the terms and the rules that you have already committed to memory.

On the actual exam, of course, you should not perform the calculations step by step as is done in the solution guide. For time reasons, you should be able to perform a series of simple calculations immediately in your head, saving your time and energy to focus on the truly difficult aspect of the questions. For example, if a question gives Funding Target = \$100,000, assets = \$80,000, and Prefunding balance = \$10,000, it is hoped that you will immediately see a plan that is 70% funded, without having to waste a moment's thought on the calculations: \$80,000 minus \$10,000 equals \$70,000; and \$70,000 divided by \$100,000 equals 70%. (All of these terms will be defined in the book, so don't worry if you do not recognize them from your previous plan work experience.)

The exam called the EA-2F was introduced in 2013. Prior to 2013, the exams were named differently, and the split of the information on the exams was a bit different. All of the exams from 2013 on have followed the current syllabus (even though the official syllabus itself was not updated until the 2014 exam). If you understand all of the review questions for each chapter and the questions and solutions for the five most recent tests, you should be ready to pass the exam you will actually take in November 2023 (which will follow the same syllabus as the last three exams).

Thank you for your purchase of this book. It is my sincere hope that its contents will help you to pass the exam the next time it is offered in November 2023. Remember that the key to the test is to see immediately what the question is asking and how to most quickly move to that solution. For this reason, it is often a good idea to read a question from the bottom up - first read the question that is asked, and then read through the information provided. Knowing the question you are focusing on from the start may help you choose more quickly just what material is relevant and toward what purpose. This method may or may not help - some candidates prefer to read the question through from the top down. It is suggested you use the three past exams to determine what methods work best for you - *before* you step into the exam room for the actual test.

Also, once you have solved a question, it is best to read it through one last time - to make sure there is no information in the question that you may have overlooked that affects the answer. For every fact given in a question, ask yourself - Did I take that into account? - and if not, is that because it is not relevant to the solution? The exam writers do not consider any of the given information to be "red herrings," but occasionally information is provided that is not needed, if only to give at least one extra possibility of calculating a wrong answer.

The test is designed with the intent that a properly prepared test taker can and will have sufficient time to complete and answer all of the questions, but the totality of questions do contain

enough detail to require the full four hours provided. The key is to be able to answer each question in as little time as necessary, and this book attempts to install such quickness through repetition – solving so many questions so many times that you build your familiarity with the funding methods and their various components. This book attempts to make this point by providing as many practice questions and answers as practical.

Good luck on your examination in November, and if you have any suggestions about how to improve this book, or questions about any of the material it contains – please give us your feedback with the form provided on the following page.

Michael J. Reilly, ASA, EA, MAAA
August 2023

An Introduction to the EA-2 (Segment F) Exam

In 1974, Congress passed the Employee Retirement Income Security Act (ERISA), a pension law designed to protect employer sponsored retirement plans by, among other things, forcing plan sponsors to follow fundamental rules for calculating and making sufficient contributions to such plans. To be certain that plan sponsors properly followed the requirements of the law, ERISA created the enrolled actuary designation, and empowered the Joint Board for the Enrollment of Actuaries (JBEA) – a new agency under the Treasury Department – to determine the minimum requirements and testing procedures for obtaining the designation.

Currently, there are three exams needed to obtain an Enrolled Actuary designation. The first (exam EA-1) focuses on the actuarial mathematics regarding retirement plans, and the second exam (EA-2 (Segment L)) focuses on aspects of US law with regard to such plans. This book deals with the third and final exam, EA-2 (Segment F) (also called the EA-2F – this book will use both exam names interchangeably), which focuses on proper funding of defined benefit plans - including the annual determination of minimum required funding amounts, maximum tax deductible funding amounts, proper reporting of the valuation results by the plan actuary, and knowledge of excise taxes related to failure to meet minimum funding requirements or exceed deduction limits.

ERISA, as originally passed, required the Enrolled Actuary to assign, within certain guidelines, a funding method to determine the annual required funding of a defined benefit retirement plan. Over the 30+ years since ERISA was passed, Congress has enacted dozens of laws which cumulatively have made hundreds of changes, adjustments, clarifications, and additions to the original set of rules contained in ERISA, many dealing with the funding rules for plans. The IRS, in their interpretation of these laws and changes, has come to recognize and approve certain established funding methods to be tested on this exam.

In 2006, Congress passed the Pension Protection Act (known as PPA '06, or, as will be used throughout this book, simply 'PPA'). Whereas ERISA had established a group of several funding methods from which the actuary could choose, PPA mandates a single funding method that must be used by the actuary in all plan years for single employer sponsored plans. The funding methods under ERISA may still be used, however, for certain collectively bargained plans referred to as “multiemployer” plans.

An Enrolled Actuary must have a familiarity and understanding of both the funding methods under ERISA and the single funding method mandated by PPA. The chapters in this study guide will describe first the PPA method for funding single employer plans (chapters 1-7) and then multiemployer plans (chapters 8-13), although there will be some overlap between these two plan types so that some chapters will be applicable to all plans.

Syllabus

The syllabus for the 2023 EA-2F exam is reprinted below, from the Joint Board’s examination booklet for 2023:

Actuarial cost methods, including unit credit, projected unit credit, entry age normal, individual level premium, aggregate, individual aggregate, attained age normal, frozen initial liability, shortfall, one-year term, and variations thereof.

Determination of the actuarial (i.e. smoothed) value of assets.

Valuation of ancillary benefits.

Selection of assumptions.

Valuation techniques for handling employee contributions.

Effect on valuation results of various patterns of experience, including experience with respect to investment earnings, changes in asset value, mortality, disability, employee turnover, changes in compensation, retirement, choice of retirement options, and Social Security.

Effect on valuation results of changes in plan provisions, actuarial cost methods, asset valuation methods, and actuarial assumptions.

Minimum funding requirements including, but not limited to:

For single employer plans (including multiple employer plans), determination of the minimum required contribution, including calculation of funding target and target normal cost, at-risk provisions, transition rules, effects of IRC section 436 on plan funding, PRA funding relief and MAP-21 and HATFA stabilization provisions, funding balance(s), and waivers of minimum required contributions

For multiemployer plans, the basics of the minimum funding standards including those for plans in critical or endangered status, amortization periods, credit balance, funding standard account, amortization period extensions, and waivers of funding deficiencies

Required quarterly contributions and liquidity shortfall

Certain funding relief provisions contained in the American Rescue Plan Act of 2021 (“ARPA 2021”)

Deductible limits for federal income tax purposes.

Penalty taxes for failures to meet minimum funding standards.

The syllabus shown above has not significantly changed in recent years. The current syllabus represents a fundamental change from the syllabus for exams prior to 2013. In connection with the change made in 2013, the EA2 exam names have changed from 2A and 2B to Segment F and Segment L, and certain topics have moved from one exam to the other. Remember that Segment F given in November presumes knowledge of Segment L given in May. Some topics that affect both segments (maximum benefits, top heavy rules, AFTAP rules) are now covered in depth on the Segment L exam, but are still found on the Segment F to the extent that they affect pension funding. These topics are covered in this guide to the extent they may appear on this exam, but you may want to review your study notes from the Segment L exam for more in-depth analysis of these topics.

What part of the syllabus should you spend the most time studying?

The ideal test candidate will become familiar with all aspects of the syllabus, and will be ready to correctly answer every question that is asked on the exam. That being said, very few candidates will score 100% on the exam, and candidates will not be expected to be perfect to receive a passing grade. So the first step in preparing for a successful exam is to know the number and value of questions typically asked on the exam for each syllabus topic.

The following chart shows the syllabus topics one by one, along with the number of test questions and point values of that topic for the most recent three annual exams. Many questions could have been assigned to more than one topic, since they covered elements that overlap more than one area. But for simplicity, each question has been assigned to only one topic, which *best* describes the topic of the question. The topics in the chart below do not match exactly the syllabus above. The chart is meant to reflect the categories of questions actually asked on the exam. Everything in the syllabus above is covered, either directly or indirectly, in the chart below.

It is assumed that exam candidates are familiar with Actuarial Standards of Practice (ASOPs) No. 4, No. 27, No. 35, and No. 51, as listed in the Joint Board Exam Booklet suggested readings, as well as all Society of Actuaries study notes listed. All ASOPs can be downloaded at no cost from the website of the Actuarial Standards Board. An outline of each ASOP is provided with this study manual. The study notes are available from the Society of Actuaries, which may charge a fee for the study notes. The topic of actuarial assumptions does not appear in the table below:

<https://www.irs.gov/tax-professionals/enrolled-actuaries/joint-board-examination-program>

Here is the table, as it applies to the 2018, 2019, 2020, 2021, and 2022 exams:

| Topic | 2018 Questions | 2019 Questions | 2020 Questions | 2021 Questions | 2022 Questions |
|---|--|---|--|--|--|
| PPA funding rules for single employer plans: includes determination of the minimum required contribution, funding target and target normal cost, calculation and use of funding balances, discounting employer contributions including contributions to satisfy quarterly installments, completion of Form 5500 Schedule SB, transition rules, effects of IRC section 436 (AFTAP) rules on plan funding, PRA funding relief and MAP-21 stabilization provisions, rules for multiple employer plans, and waivers of minimum required contributions | 1, 3, 7, 11, 12, 16, 18, 22, 23, 25, 26, 28, 29, 30, 31, 33, 37, 40, 41, 42, 44, 47, 49, 50, 54, 55 [69 points] | 3, 7, 8, 9, 10, 13, 16, 17, 20, 25, 26, 27, 29, 32, 33, 38, 40, 43, 45, 46, 49, 51, 53, 54, 55 [68 points] | 1, 2, 6, 7, 9, 13, 18, 21, 22, 23, 24, 25, 27, 29, 33, 34, 37, 43, 44, 46, 49, 50, 55 [66 points] | 3, 7, 9, 12, 15, 16, 21, 22, 24, 25, 27, 29, 31, 32, 34, 35, 36, 37, 38, 41, 42, 43, 51, 52, 54, 58 [70 points] | 1, 2, 3, 22, 27, 28, 29, 32, 33, 34, 35, 38, 42, 44, 47, 49, 51, 54, 56, 57, 59 [56 points] |
| Funding rules for multiemployer plans: Actuarial cost methods, minimum funding standards, amortization periods, credit balance, funding standard account, amortization period extensions, and waivers of funding deficiencies | 2, 4, 6, 8, 13, 17, 21, 27, 32, 36, 46 [34 points] | 12, 18, 22, 30, 36, 39, 42, 56 [30 points] | 4, 10, 12, 14, 16, 19, 31, 32, 39, 40, 41, 56, 57 [45 points] | 1, 2, 4, 10, 19, 28, 30, 39, 44, 50, 60 [34 points] | 10, 11, 25, 36, 40, 46, 50, 55 [27 points] |
| Multiemployer plans in critical or endangered status | 9 [2 points] | 5 [3 points] | None [0 points] | 46, 47 [7 points] | 12, 16 [6 points] |
| Deductible limits for federal income tax purposes (both single and multiemployer plans are covered in these questions). | 52 [4 points] | 1, 15 [4 points] | 20, 30 [7 points] | 45, 57 [4 points] | 15, 24, 48 [5 points] |
| Effect on valuation results of changes in plan provisions, actuarial cost methods, asset valuation methods and actuarial assumptions. | 10, 15, 34, 56 [13 points] | 4, 24, 41, 44, 50 [14 points] | 17, 35, 51, 53 [12 points] | 13 [1 point] | 37, 39, 45, 53, 58 [16 points] |
| Effect on valuation results of various patterns of experience, including experience with respect to investment earnings, changes in asset value, mortality, disability, employee turnover, changes in compensation, retirement, choice of retirement options, and Social Security. | 19, 38, 39, 45, 51 [16 points] | 6, 34, 35 [11 points] | 42 [4 points] | 8, 17, 20 [12 points] | 19 [4 points] |

| Topic | 2018 Questions | 2019 Questions | 2020 Questions | 2021 Questions | 2022 Questions |
|--|---------------------------|---------------------------------|---------------------------------|------------------------------|--|
| Selection of actuarial assumptions and effect of such selection on plan funding | 43 [2 points] | 2, 21, 23, 47, 58 [7 points] | 8, 11, 45, 47, 54 [8 points] | 5, 6, 14, 55 [8 points] | 5, 6, 7, 17, 20, 31, 41, 43 [12 points] |
| Determination of the actuarial (i.e. smoothed) value of assets – applicable to both single employer and multiemployer plans – albeit with different rules. | 14, 20, 53 [11 points] | 11, 31, 48 [10 points] | 15, 48 [7 points] | 18, 33, 40, 59 [9 points] | 4, 9, 21, 26 [15 points] |
| Valuation of ancillary benefits. | 5, 24 [5 points] | 37 [4 points] | 36, 38 [5 points] | 11, 53 [4 points] | 18, 23, 60 [6 points] |
| Valuation techniques for handling employee contributions. | None [0 points] | None [0 points] | 28 [2 points] | None [0 points] | None [0 points] |
| Liquidity shortfall requirements | None [0 points] | 19, 28 [2 points] | 3 [1 point] | 23, 26, 56 [7 points] | 52 [4 points] |
| Penalty taxes for failures to meet minimum funding standards. | 35, 48 [4 points] | 14, 52, 57 [7 points] | 5, 26, 52 [3 points] | 48, 49 [4 points] | 8, 13, 14, 30 [9 points] |

The focus of the exam is funding methods for plans (the first two topics listed in the chart), with the emphasis on plans that are sponsored by single employers (the first topic).

All of the remaining topics are, in some way, elements of the actuarial valuations that produce minimum funding levels for the year. For this reason, this study guide will focus only on the actuarial valuation and funding methods. The remaining topics will be covered as results of such funding methods. The study and knowledge of proper actuarial valuation methods – under PPA for single employer plans and under pre-PPA ERISA for multiemployer plans – is the critical feature being tested by the JBEA through the EA-2F exam.

The exam is four hours long, and the point values of all questions total 160 points. Each point theoretically represents about 1½ minutes of exam time. The exam contains several true/false questions worth one point, meaning they should take no more than about 1½ minutes of consideration. The other questions involve calculations and are scored between 2 (3 minutes) and 5 (about 7½ minutes) points.

Structure of this book

Chapters 1 through 5 of this book will describe the funding method for single employer plans mandated by PPA in a piece by piece fashion. Although some of the issues discussed in the first five chapters will apply to multiemployer plans as well as single employer, the principal aim of chapters 1-5 is to get the candidate, through a process of repetition, thoroughly versed in the aspects of the PPA valuation method. This book will focus on the names, definitions, and interactions of the various terms used under the method, acceptable asset valuation methods under PPA, and the nuances of calculating the amounts needed to meet the minimum required contribution requirements of the PPA method.

Chapters 6 and 7 will discuss maximum deduction limits and at-risk plan rules as they apply to single employer plans (deduction limits for multiemployer plans will be discussed later – at-risk funding rules do not apply to multiemployer plans).

Chapters 8, 9, and 10 will discuss minimum funding rules for multiemployer plans, including various actuarial cost methods not contained in PPA, and the costs and credits applied in maintaining the Funding Standard Account for a multiemployer plan from year to year.

Chapters 11 and 12 correspond to chapters 6 and 7 for single employer plans. These two chapters will discuss the maximum deduction rules as they apply to multiemployer plans, and the rules regarding critical and endangered status of such plans when they are underfunded (as opposed to “At-Risk,” the term for an under funded single employer plan).

Each chapter will start with a discussion of the issues to be covered in that chapter, and may include questions and/or examples designed to illustrate the topics covered in the chapter. Review questions at the end of each chapter are taken from past exams. Past exams are an ample source of questions on these topics, and will introduce the reader to the format of questions given on the exam in past years.

The best preparation for future test questions, however, remains the questions that have been asked on the most recent prior exams. This book includes copies of the EA-2F exams given in November 2018, 2019, 2020, 2021, and 2022.

The book also contains solutions to the questions on the five exams. It is recommended that you take the previous exams under simulated exam conditions and within the exam time period.

Whether you simulate taking the prior exams under exam conditions or not, it is strongly recommended that you read through all of the detailed solutions to the questions on the three most recent exams. Keep in mind that the solutions are detailed and that they will explore different topics in a manner that should not be duplicated on the actual exam, for time reasons, but which will be very helpful in describing to the student the way that a small change in the question would affect the manner in which the answer is arrived at.

Many exam questions hinge on one or more small points in the law which, for space reasons, cannot all be discussed in depth in the book's text, but can be addressed in the context of a specific exam solution. Learning methodology in the book's chapters and sample questions and answers is helpful, but seeing the methodology applied to actual examples of questions from previous exams will be the most productive form of studying. Once you are thoroughly familiar with the types of questions asked, the answers to the questions, and, most importantly, the *reasons* the answers are correct, you will be ready to take and pass the 2023 examination.

AMERICAN RESCUE PLAN ACT OF 2021

The American Rescue Plan Act of 2021 (“ARPA 2021”) was signed into law on March 11, 2021. This law provides for Special Financial Assistance (“SFA”) to financially distressed multiemployer pension plans, offers funding relief to multiemployer and single employer pension plans, and increases the multiemployer PBGC premiums for plan years beginning after December 31, 2030. The law’s main provisions are summarized as follows:

I. Special Financial Assistance (“SFA”)

ARPA 2021 appropriated funds (known as “SFA”) to be distributed to financially distressed multiemployer pension plans which meet certain criteria. Such SFA is intended to help financially distressed multiemployer pension plans meet their financial obligations through 2051 (30 years after the law’s enactment).

Multiemployer pension plans which are seeking SFA must file an application with the PBGC for approval no later than December 31, 2025 (December 31, 2026 for re-submitted applications). Upon approval of an application, SFA is distributed to the multiemployer pension plan as a lump sum and there is no repayment obligation.

Multiemployer pension plans which receive SFA will be deemed to be in critical status beginning with the plan year in which the effective date of the SFA occurs and ending with the last plan year ending in 2051. As such, plans receiving SFA are restricted from improving benefits and reducing contributions in accordance with the limitations imposed on plans in critical status. Additionally, plans receiving SFA that previously implemented benefit suspensions under the Multiemployer Pension Reform Act of 2014 (“MPRA”) are required to restore the suspended benefits and are prohibited from implementing MPRA benefit suspensions in the future.

SFA must be kept separately from the plan’s other assets, is restricted from risky investments, and can only be used for paying the plan’s benefit payments and expenses.

A multiemployer pension plan must meet one of the following conditions in order to be eligible for SFA:

1. The plan is in critical and declining status, or
2. The plan was approved for MPRA benefit suspensions as of March 11, 2021, or
3. The plan became insolvent after December 16, 2014 and is not terminated as of March 11, 2021, or
4. The plan meets all of the following conditions:

- a. Certified to be in critical status in any plan year beginning in 2020 through 2022, and
- b. The current value of assets divided by the current liability is less than 40% for any plan year beginning in 2020 through 2022, and
- c. The ratio of active to inactive participants is less than 2 to 3 in any plan year beginning in 2020 through 2022.

II. Funding Relief for Multiemployer Pension Plans

The following three funding relief measures apply to multiemployer pension plans:

1. **Election of Section 432 Status.** For the first plan year beginning between March 1, 2020 and February 28, 2021, plans are permitted to elect for the status for this plan year under Section 432 of the Internal Revenue Code to be the same as the immediately preceding plan year. For plans that are not in critical status under such election, but would be in critical status absent this election, the plan is exempt from the excise tax on any funding deficiency that is required under Code Section 4971.
2. **Extension of Funding Improvement and Rehabilitation Periods.** Plans in endangered or critical status for a plan year beginning in 2020 or 2021 may elect to extend its funding improvement or rehabilitation period by 5 years, thus increasing the overall period from 10 years to 15 years. Plans in seriously endangered status for a plan year beginning in 2020 or 2021 may elect to extend its funding improvement period by 5 years, thus increasing the overall period from 15 years to 20 years.
3. **Extended Amortization Period for Adverse COVID-19 Experience.** Plans that have not received SFA and that are not facing insolvency may elect to amortize adverse experience resulting from COVID-19 for the first plan year beginning after February 29, 2020 over a period of 30 years instead of the typical 15 years for experience amortization bases.

III. Funding Relief for Single Employer Pension Plans

The following two funding relief measures apply to single employer pension plans:

1. **Extension of Period for Shortfall Amortization Installments.** The shortfall amortization base period is extended from 7 years to 15 years with respect to plan years beginning after December 31, 2021. Plans may elect for this extension to apply to an earlier plan year beginning after December 31, 2018. All outstanding shortfall amortization bases for plan years prior to the first plan year to which the 15-year amortization applies are eliminated.

2. **Segment Rate Stabilization.** Per Section 430(h)(2)(C) of the Internal Revenue Code, each of the valuation segment rates must fall within a corridor of the 25-year average of applicable segment rates. ARPA 2021 imposed a floor on the 25-year average segment rate of 5.00% and defined the corridor around the 25-year average segment rates for future years as follows:

| Calendar Year | Minimum Percentage | Maximum Percentage |
|---------------|--------------------|--------------------|
| Through 2030 | 95% | 105% |
| 2031 | 90% | 110% |
| 2032 | 85% | 115% |
| 2033 | 80% | 120% |
| 2034 | 75% | 125% |
| After 2034 | 70% | 130% |

IV. PBGC Premiums for Multiemployer Pension Plans

The multiemployer premium rate per plan participant is set to increase to \$52 for plan years beginning after December 31, 2030. Such premium rate is to be indexed to the Social Security national average wage index for subsequent years.

CHAPTER 1

DEFINITIONS

Based on recent prior year exams, about 35% of the entire test will be on some variation of determining the mandatory minimum contribution to a single employer defined benefit retirement plan, or on determining some value needed to determine such minimum mandatory contribution. Because so much of the test hinges on this calculation, the first five chapters of this book will focus on the calculation, piece by piece.

You may already have experience performing PPA method valuations for single employer plans. Even if this is so, please read through the first five chapters carefully. You may be surprised which items you currently perform are mandatory under the law, and which are choices for which there are other alternatives. Many exam questions hinge on options that are available under law, but are practiced so rarely in real life cases that some exam takers are unaware they are available.

This chapter 1 will begin by defining terms used in what will be referred to as the PPA funding method (named for the Pension Protection Act of 2006, the law that describes and mandates the funding method), which is generally the only method permitted for single employer defined benefit plans after 2007. The following terms are taken directly from Internal Revenue Code §430, except where otherwise indicated, and are commonly used on the EA-2F exam questions.

If you have been actively involved in performing actuarial valuations for single employer plans, you will already be familiar with the following terms, and can use this chapter as review of the exact method by which they are determined. If the following terms are not already familiar to you, you may have some trouble understanding new terms which refer to other terms that will be defined and discussed in later chapters. Keep in mind that the first five chapters of this book explain the PPA funding method as a block, and all of the terms used in all of the chapters will make sense once all of the first five chapters have been reviewed.

Valuation Date - A tax qualified defined benefit plan is valued by the plan's Enrolled Actuary each year on the plan valuation date. All present values are determined as of the valuation date, and all costs and contributions to the plan are adjusted by interest to the valuation date.

Under PPA, all plans with more than 100 participants must use the first day of the plan year as the actuarial valuation date for that year. This is assumed to be January 1st for exam questions, unless information suggesting a different date is given in the question. PPA does allow plans with less than 100 participants to use any other day of the year as the valuation date. In practice, nearly all plans with less than 100 participants will use either the first or last day of the plan year as the valuation date, although other dates are permitted.

Funding Target (FT) – The present value of all benefits earned or accrued as of the beginning of the year (i.e., accrued benefits attributable to service prior to any service performed in the valuation plan year).

Target Normal Cost (TNC) – The present value of benefits actually accrued or expected to accrue during the current plan year. Target Normal Cost includes any increase in benefits earned in prior years due to expected or actual increases in average compensation at the end of the current year. TNC is increased to include plan expenses paid or expected to be paid from the plan trust during the plan year. TNC reflects the cost to the *employer* of benefits accruing during the

year. Therefore, TNC is also decreased to reflect any *employee* contributions made or expected to be made to the plan.

Because the valuation date can be either at the start or end of the plan year (for plans with under 100 participants only), TNC is defined to represent the value of either benefits *actually accrued* (such benefits would be known if the actuary is performing an end of year valuation) or benefits *expected to accrue* during the year (a beginning of year actuarial valuation could be performed before any benefits actually accrue for a year, and so the TNC would have to be based on benefits expected to accrue under reasonable actuarial assumptions).

While PPA explicitly allows plans with less than 100 participants to use a valuation date other than the first day of the year, the remainder of the law, the Internal Revenue Code, the IRS regulations regarding the funding method, and the Schedule SB often seem to have been designed based on the assumption that an actuarial valuation would be performed as of the first day of the plan year. Often, special rules and exceptions have to be applied to the general rules to accommodate a valuation as of any other day of the plan year (and many of these rules are open to an actuary's discretion, rather than directly addressed by published guidance from applicable government agencies). Most questions on the exam will be based on a valuation date on the first day of the plan year (all exam questions assume a plan year equal to the calendar year, and a January 1st valuation date, unless explicitly stated otherwise in the question), and this book will assume the same in describing the funding method.

Illustration. An actuary performs a January 1st valuation. Benefits are based on a participant's Average Monthly Compensation and length of service. On January 1st, all past service and compensation are known, and the actuary calculates that all benefits of all participants have a present value of \$1,000,000 on January 1st. The actuary does not know what participants' compensation will be at year end, nor can the actuary know for sure, on January 1st, which participants will earn an additional year of service by year end. Based on reasonable assumptions regarding service and compensation increases, the actuary determines that the present value of all year end benefits, discounted to January 1st, will increase to \$1,100,000. The valuation FT is \$1,000,000 and TNC is \$100,000. More details of these calculations will be discussed in chapter 2.

TERMS RELATED TO MINIMUM FUNDING

Minimum Required Contribution (MRC) – MRC is a term defined in IRC section 430 and is determined by one of two formulas, depending on whether the plan assets on the valuation date are greater or less than the valuation FT. First compare assets to FT. Then –

(A) If assets < FT, then the plan has a funding shortfall equal to FT minus assets. The shortfall must be serviced by an amortization charge, as will be discussed below. The valuation MRC = TNC + shortfall amortization charge + waiver amortization charge (see note below);

(B) If assets => FT, then MRC = TNC – (assets – FT). However, the plan's MRC can never be less than \$0.

In all of the following examples, the valuation FT = \$1,000,000 and TNC = \$100,000 (as in the illustration above).

Example 1. Plan assets on Jan 1 are \$1,000,000. Assets minus FT = \$0; and MRC = \$100,000 - \$0 = \$100,000. The plan is exactly 100% funded at the start of the year valuation date, and the only contribution required is for the benefits expected to accrue in the upcoming year. If all assumptions are realized exactly, the plan will still be 100% funded at year end.

Example 2. Plan assets on Jan 1 are \$1,080,000. Assets minus FT = \$80,000; and MRC = \$100,000 - \$80,000 = \$20,000. The plan is more than 100% funded at the valuation date, and the plan sponsor can contribute less than the cost of benefits expected to accrue in the upcoming year, allowing the excess to fund some of those upcoming benefits. Once again, if all assumptions are realized exactly, and the employer contributes the MRC, then the plan will still be exactly 100% funded at year end.

Example 3. Plan assets on Jan 1 are \$920,000. The plan has a shortfall of \$80,000. MRC = TNC of \$100,000, plus an amortization charge to reduce the shortfall. If the shortfall charge is less than the shortfall, the plan will remain less than 100% funded at year end, but eventually, the shortfall will be reduced to \$0, and the plan will be 100% funded. Funding the plan to 100% or more of benefit liabilities is the ultimate goal of the MRC determined under the PPA funding method.

The MRC is determined by the appropriate mathematical formula given above. Despite the name of this term, it is NOT the minimum amount that an employer is required to contribute to the plan on any given date. For this reason, exam questions will often ask for the “smallest amount that satisfies the minimum funding standard” for a plan year. The interaction between the term “smallest amount” and the MRC is analyzed further in Chapter 5.

REDUCED ASSETS

The term assets in the discussion of MRC above, actually means Reduced Assets. Reduced Assets is the actuarial value of plan assets determined on the valuation date, minus the plan’s PFB and COB.

Prefunding balance (PFB) – An employer that makes contributions to a plan that are greater than the mandatory Minimum Required Contribution (MRC) may choose to add (the addition is not automatic and is not mandatory) such excess to the plan’s PFB. A plan’s PFB is defined to be \$0 at the start of the first plan year to which the PPA funding method applies (this is the start of the 2008 plan year for plans that existed prior to 2008, or the effective date of the plan for plans adopted thereafter). Thereafter, the PFB may be increased by excess contributions made by the employer, and is adjusted from year to year according to interest earned by the plan trust.

After a PFB is established, the plan sponsor may use the existing PFB to reduce the plan’s MRC (subject to certain restrictions) on a later valuation (the PFB is also reduced when it is applied in this manner). This is one of the ways, discussed in chapter 5, that the smallest amount an employer may contribute can be less than the MRC.

Example 4. The facts are the same as in Example 1, but the plan now has a PFB of \$100,000 on the Jan 1 valuation date. If the result of example 1 is not changed, the MRC of \$100,000 could be reduced to \$0 by the PFB, and the employer’s contribution would be \$0.

However, this would result in \$1,100,000 year end benefit liabilities funded by only \$1,000,000 of assets. This would fall outside of the funding method’s goal of fully funding the plan. To avoid such a result, the valuation is changed as follows:

Adjusted assets = assets – PFB = \$1,000,000 - \$100,000 = \$900,000. Adjusted assets are \$100,000 less than FT, creating a shortfall and an amortization charge. The MRC is the \$100,000 TNC plus the shortfall amortization charge. The PFB can reduce the contribution amount by \$100,000. By using the PFB, the plan sponsor has reduced the MRC from the full TNC of \$100,000 to an amortized payment on such amount. This example shows the value of the PFB – it does not reduce the amount that an employer must fund a plan in the long run, but it can allow the sponsor to amortize such payments over time.

Depending on the circumstances of the plan valuation, the fact that a plan has an excessive PFB could cause a larger MRC than would otherwise apply. For this reason, a plan sponsor may voluntarily reduce the PFB of a plan at any time, subject to conditions established by the IRS.

Carryover balance (COB) – Plans that existed prior to the 2008 plan year (the first year single employer plans were required to use the PPA funding method) and that had a funding standard account credit balance at the end of the 2007 plan year (based on the various funding methods permitted under ERISA, which will be described in Chapter 8) could convert such credit balance to a carryover balance, a newly defined term under PPA, as of the start of the 2008 plan year. The COB is similar to the PFB, except that a plan sponsor may not add to it (excess contributions can be placed into the PFB only), and the rules for reducing assets by subtracting the COB apply in different ways than subtracting the PFB (see below).

The plan's COB may be reduced for the same two reasons a PFB may be reduced (application to reduce the MRC or voluntary reduction by plan sponsor). Furthermore, no portion of the PFB may be reduced until the COB is reduced to \$0. Once the COB of a plan is reduced to \$0, it can never again be increased to any amount greater than \$0. Plans effective after 2007 (which have an initial COB of \$0) will always have a COB of \$0.

Under PPA, the COB was created as a reward to plans that had made excess funding contributions under pre-PPA ERISA. In some ways, a plan's COB is more valuable than the PFB created after PPA.

Since the year 2008, plans that continue to maintain a COB have become rarer each year, with very nearly all plans using only a PFB to reflect past excess plan contributions. As a result, many exam questions will feature a plan with excess funding in the form of a plan's PFB, but the plan's COB is stated to be (or assumed to be) \$0. However, an exam question might still describe a plan that maintains a COB, and so an exam candidate should understand both the PFB and the COB, their differences, and their similarities in actual application.

Methods of Reducing Assets. Code Section 430(f)(4) lists three different methods of reducing assets. Generally speaking, assets must be reduced by both the PFB and the COB for most valuation purposes, such as determining the plan's FTAP and AFTAP, and comparing assets to the FT for determining the MRC. However, two other definitions are also used, each for a single specific purpose.

In order to apply a COB or PFB against the current year MRC, the prior year reduced assets must be at least 80% of the prior year FT. For this purpose, the prior year assets are reduced by the PFB, but not the COB.

In determining whether a plan is exempt from establishing a new funding shortfall amortization base, (see below) assets must be reduced by the PFB if, and only if, the plan sponsor uses some amount of PFB to reduce the MRC. Assets are not reduced by COB for this purpose.

TERMS RELATING TO SHORTFALL AND SHORTFALL AMORTIZATION

All of the definitions given for this section below are determined for a given plan year and are always determined as of the plan's valuation date for such year.

Funding shortfall – The plan's FT minus the reduced assets. If the funding shortfall is \$0 or less in any plan year, the current year shortfall amortization installment and all prior plan year shortfall amortization installments are set to \$0, and the plan's shortfall amortization charge for the year is equal to \$0.

Shortfall amortization base – The plan's funding shortfall minus the sum of the present values of all remaining shortfall amortization bases for prior years. The present value of a prior year's shortfall amortization base is equal to the present value of the remaining payments to be applied to such amortization base.

Shortfall amortization installment – The plan's shortfall amortization base divided by the shortfall amortization factor. Under the law as originally written, the shortfall amortization factor is always a 7-year factor. However, passage of the Pension Relief Act (PRA) in 2010 created new amortization schedules for plan sponsors to use. The PRA amortization schedules reduced the mandatory funding for a limited period of 2008-2011.

Although the expanded amortization schedules under PRA are no longer available to plans after 2011, you may need to know the schedules for purposes of calculating the present value of remaining payments under such prior schedules.

The optional methods of calculating the shortfall amortization installment are provided in detail in Chapter 4.

Shortfall amortization charge – The sum of the current year's shortfall amortization installment and the installments for all prior years that are still outstanding.

X-Year shortfall amortization factor – The present value of a payment of \$1 over the next X years, beginning with the current year. Unlike the four previous definitions, the shortfall amortization factor is not defined in the Tax Code. However, this terminology has been used on past exams, and candidates should be familiar with the term and expect to see it again on future exams.

Additional rules for determining the shortfall amortization amounts can be found in chapter 4.

Waiver amortization charge – A payment for a prior year waiver of the employer's funding obligation, to be repaid over a specified future number of years. The decision to grant a funding waiver is made by the Treasury Department and is based on the employer's ability to make the required funding contribution. The factors for making the decision of whether to grant such a waiver are not an appropriate subject for an actuarial exam. As part of the general conditions for the exam, plans are assumed to not have any outstanding funding waivers and to never have had a

funding waiver for the history of the plan. Thus the funding waiver rule may be ignored unless a question specifically refers to such a waiver

If a plan has a funding waiver, the outstanding balance of remaining waiver re-payments is considered a base which reduces the current year shortfall amortization base in the same manner as past shortfall amortization bases. The rules to set up and amortize a funding waiver base will be discussed in detail in chapter 4.

TYPES OF PLANS

Single employer plans – As mentioned at the start of this chapter, the rules described in chapters 1 through 5 of this manual apply to single employer plans. Single employer plans include plans sponsored by a single employer, as well as plans sponsored by two or more employers that are treated as a single employer because they are members of a controlled group or Affiliated Service Group (ASG) of employers (these terms are defined in the EA-2L study materials).

Multiple employer plans – If a group of two or more employers that are not members of a controlled group or ASG choose to jointly sponsor a defined benefit plan with the same features for all employees, the plan is a multiple employer plan. Each employer that co-sponsors a multiple employer plan is subject to the minimum funding rules with respect to their own employees in the same manner as a single employer plan.

Prior to 1988, the law allowed the sponsors of a multiple employer plan to treat the entire plan as a single employer plan for funding purposes. This method creates a single funding number for the entire plan, and all of the sponsoring employers are responsible for making such contribution. When the law changed in 1988, multiple employer plans that funded as a single plan could elect to be grandfathered into this method. All plans established after 1988 did not have the option to fund as a single plan.

If an exam question is about a multiple employer plan, you should assume that each sponsoring employer is subject to the funding rules based only on benefits for its own employees. You should treat the plan as funded on a combined basis only if the question states that the plan was both established prior to 1988 and made the election to be treated as a single plan for funding purposes.

Multiemployer plans – A plan that is established pursuant to one or more collective bargaining agreements for a common group of union employees who may work for multiple employers is called a multiemployer plan. Unlike a multiple employer plan, a multiemployer plan is not sponsored by the employer(s). The plan is sponsored by the union to which the participants belong, and the employers are required to fund the plan according to the terms of the bargaining contracts.

Although the names are similar, do not confuse a multiemployer plan with a multiple employer plan. Multiemployer plans are not funded according to the rules in chapters 1 through 7, but instead the funding rules described in chapters 8 through 12. A multiemployer plan will not develop a FT, TNC, COB, or PFB – although multiemployer plan funding will have similar concepts with different names.

TERMS USED IN THIS GUIDE

Common abbreviations: Several of the terms above have been given standard abbreviations by actuaries working under PPA. For the remainder of this book the terms FT, TNC, COB, PFB, and MRC will be used instead of the term for which each stands, as has already been done in the definitions above.

In addition, the terms Internal Revenue Code, IRC, and Code shall be used interchangeably throughout the book and will reference applicable Internal Revenue Code sections as amended at the time of the exam. The term “IRS regulations” will be used interchangeably with “Treasury regulations.” “IRS regulations” is not an actual term used by the federal government (such regulations are issued by the Department of the Treasury and are technically called Treasury regulations, but IRS regulations is a term used by enrolled actuaries in common actuarial practice and so will be used freely in this book.

Any reference in this book to “single employer plans” includes multiple employer plans that are treated as a group of single employer plans.

EXAMPLES

Most of the PPA terms are related to each other through simple algebraic equations described in the above definitions. A well prepared candidate for this exam must know all of the terms and their exact meaning. For example, you should know instantly the difference between a funding shortfall charge, a funding shortfall installment, and a funding shortfall base. Doing so will save you valuable exam time spent trying to understand just what is being asked on an exam question.

To increase your familiarity with these terms and improve your speed in performing the basic calculations of these amounts, the following questions require you to determine the missing values based on the values of terms actually given. The steps for moving from the funding shortfall to the shortfall amortization charge (based on the current and prior years’ funding shortfall bases and installments) have been omitted in the following examples. These steps will be covered in more detail in Chapter 4:

1.

| | |
|--------------------------------|-----------|
| Funding Target: | \$200,000 |
| Target Normal Cost: | \$ 10,000 |
| Actuarial Value of Assets: | \$180,000 |
| Prefunding Balance: | \$ 20,000 |
| Reduced Assets: | ??? |
| Funding Shortfall: | ??? |
| Shortfall amortization charge: | \$ 15,000 |
| Minimum Required Contribution: | ??? |

2.

| | |
|--------------------------------|-----------|
| Funding Target: | \$400,000 |
| Target Normal Cost: | \$ 50,000 |
| Actuarial Value of Assets: | \$520,000 |
| Prefunding Balance: | \$100,000 |
| Reduced Assets: | ??? |
| Funding Shortfall: | ??? |
| Shortfall amortization charge: | ??? |
| Minimum Required Contribution: | ??? |

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| | | |
|----|--------------------------------|-------------|
| 3. | Funding Target: | \$500,000 |
| | Target Normal Cost: | ??? |
| | Actuarial Value of Assets: | \$250,000 |
| | Prefunding Balance: | ??? |
| | Reduced Assets: | ??? |
| | Funding Shortfall: | \$300,000 |
| | Shortfall amortization charge: | \$ 35,000 |
| | Minimum Required Contribution: | \$ 75,000 |
| 4. | Funding Target: | \$300,000 |
| | Target Normal Cost: | \$ 20,000 |
| | Actuarial Value of Assets: | ??? |
| | Prefunding Balance: | \$ 0 |
| | Reduced Assets: | \$250,000 |
| | Funding Shortfall: | ??? |
| | Shortfall amortization charge: | \$ 25,000 |
| | Minimum Required Contribution: | ??? |
| 5. | Funding Target: | ??? |
| | Target Normal Cost: | \$ 60,000 |
| | Actuarial Value of Assets: | \$500,000 |
| | Prefunding Balance: | \$ 20,000 |
| | Reduced Assets: | ??? |
| | Funding Shortfall: | ??? |
| | Shortfall amortization charge: | ??? |
| | Minimum Required Contribution: | \$ 30,000 |
| 6. | Funding Target: | ??? |
| | Target Normal Cost: | \$ 25,000 |
| | Actuarial Value of Assets: | ??? |
| | Prefunding Balance: | \$ 0 |
| | Reduced Assets: | \$300,000 |
| | Funding Shortfall: | \$ 75,000 |
| | Shortfall amortization charge: | \$ 15,000 |
| | Minimum Required Contribution: | ??? |
| 7. | Funding Target: | \$1,000,000 |
| | Target Normal Cost: | ??? |
| | Actuarial Value of Assets: | \$1,270,000 |
| | Prefunding Balance: | ??? |
| | Reduced Assets: | \$1,200,000 |
| | Funding Shortfall: | \$ 0 |
| | Shortfall amortization charge: | \$ 0 |
| | Minimum Required Contribution: | \$ 200,000 |
| 8. | Funding Target: | \$800,000 |
| | Target Normal Cost: | \$ 50,000 |
| | Actuarial Value of Assets: | ??? |
| | Prefunding Balance: | \$100,000 |
| | Reduced Assets: | \$600,000 |

| | | |
|-----|--------------------------------|--------------|
| | Funding Shortfall: | ??? |
| | Shortfall amortization charge: | ??? |
| | Minimum Required Contribution: | \$ 75,000 |
| 9. | Funding Target: | \$400,000 |
| | Target Normal Cost: | \$ 30,000 |
| | Actuarial Value of Assets: | ??? |
| | Prefunding Balance: | \$ 0 |
| | Reduced Assets: | ??? |
| | Funding Shortfall: | \$250,000 |
| | Shortfall amortization charge: | ??? |
| | Minimum Required Contribution: | \$ 50,000 |
| 10. | Funding Target: | \$10,000,000 |
| | Target Normal Cost: | \$ 2,000,000 |
| | Actuarial Value of Assets: | \$15,000,000 |
| | Prefunding Balance: | ??? |
| | Reduced Assets: | \$14,800,000 |
| | Funding Shortfall: | ??? |
| | Shortfall amortization charge: | ??? |
| | Minimum Required Contribution: | ??? |

ANSWERS

1. Reduced assets = Actuarial value of assets – PFB
 Reduced assets = \$180,000 - \$20,000 = \$160,000

Funding shortfall = FT – Reduced assets
 Funding shortfall = \$200,000 - \$160,000 = \$40,000

Since Reduced assets are less than FT,
 MRC = TNC + shortfall amortization charge
 MRC = \$10,000 + \$15,000 = \$25,000

2. Reduced assets = Actuarial value of assets - PFB
 Reduced assets = \$520,000 - \$100,000 = \$420,000

Reduced assets are greater than FT, so funding shortfall = \$0, and shortfall amortization charge = \$0, and MRC = TNC - (Reduced assets – FT)

MRC = \$50,000 - (\$420,000 - \$400,000) = \$30,000

3. Funding shortfall = FT – Reduced assets
 \$300,000 = \$500,000 – Reduced assets; Reduced assets = \$200,000

Reduced assets = Actuarial value of assets – PFB
 \$200,000 = \$250,000 - PFB; PFB = \$50,000

Since Reduced assets are less than FT,

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$$\begin{aligned} \text{MRC} &= \text{TNC} + \text{shortfall amortization charge} \\ \$75,000 &= \text{TNC} + \$35,000; \quad \text{TNC} = \$40,000 \end{aligned}$$

$$\begin{aligned} 4. \text{ Reduced assets} &= \text{Actuarial value of assets} - \text{PFB} \\ \$250,000 &= \text{Actuarial value of assets} - \$0; \quad \text{Actuarial value of assets} = \$250,000 \end{aligned}$$

$$\begin{aligned} \text{Funding shortfall} &= \text{FT} - \text{Reduced assets} \\ \text{Funding shortfall} &= \$300,000 - \$250,000 = \$50,000 \end{aligned}$$

$$\begin{aligned} \text{Since Reduced assets are less than FT,} \\ \text{MRC} &= \text{TNC} + \text{shortfall amortization charge} \\ \text{MRC} &= \$20,000 + \$25,000 = \$45,000 \end{aligned}$$

$$\begin{aligned} 5. \text{ Reduced assets} &= \text{Actuarial value of assets} - \text{PFB} \\ \text{Reduced assets} &= \$500,000 - \$20,000 = \$480,000 \end{aligned}$$

The MRC given is less than the TNC given, therefore it is known that Reduced assets are greater than FT, and so funding shortfall = \$0, and shortfall amortization charge = \$0, and $\text{MRC} = \text{TNC} + (\text{Reduced assets} - \text{FT})$

$$\$30,000 = \$60,000 - (\$480,000 - \text{FT}); \quad \text{FT} = \$450,000$$

$$\begin{aligned} 6. \text{ Reduced assets} &= \text{Actuarial value of assets} - \text{PFB} \\ \$300,000 &= \text{Actuarial value of assets} - \$0; \quad \text{Actuarial value of assets} = \$300,000 \end{aligned}$$

$$\begin{aligned} \text{Funding shortfall} &= \text{FT} - \text{Reduced assets} \\ \$75,000 &= \text{FT} - \$300,000; \quad \text{FT} = \$375,000 \end{aligned}$$

$$\begin{aligned} \text{Since Reduced assets are less than FT,} \\ \text{MRC} &= \text{TNC} + \text{shortfall amortization charge} \\ \text{MRC} &= \$25,000 + \$15,000 = \$40,000 \end{aligned}$$

$$\begin{aligned} 7. \text{ Reduced assets} &= \text{Actuarial value of assets} - \text{COB} - \text{PFB} \\ \$1,200,000 &= \$1,270,000 - \text{PFB}; \quad \text{PFB} = \$70,000 \end{aligned}$$

Reduced assets are greater than FT, so funding shortfall = \$0, and shortfall amortization charge = \$0, and $\text{MRC} = \text{TNC} - (\text{Reduced assets} - \text{FT})$

$$\$200,000 = \text{TNC} - (1,200,000 - 1,000,000); \quad \text{TNC} = \$400,000$$

$$\begin{aligned} 8. \text{ Reduced assets} &= \text{Actuarial value of assets} - \text{PFB} \\ \$600,000 &= \text{Actuarial value of assets} - \$100,000; \quad \text{Actuarial value of assets} = \$700,000 \end{aligned}$$

$$\begin{aligned} \text{Funding shortfall} &= \text{FT} - \text{Reduced assets} \\ \text{Funding shortfall} &= \$800,000 - \$600,000 = \$200,000 \end{aligned}$$

$$\begin{aligned} \text{Since Reduced assets are less than FT,} \\ \text{MRC} &= \text{TNC} + \text{shortfall amortization charge} \\ \$75,000 &= \$50,000 + \text{shortfall amortization charge}; \quad \text{shortfall amortization charge} = \$25,000 \end{aligned}$$

9. Funding shortfall = FT – Reduced assets

$$\$250,000 = \$400,000 - \text{Reduced assets}; \quad \text{Reduced assets} = \$150,000$$

Reduced assets = Actuarial value of assets – PFB

$$\$150,000 = \text{Actuarial value of assets} - \$0; \quad \text{Actuarial value of assets} = \$150,000$$

Since Reduced assets are less than FT,

MRC = TNC + shortfall amortization charge

$$\$50,000 = \$30,000 + \text{shortfall amortization charge}; \quad \text{shortfall amortization charge} = \$20,000$$

10. Reduced assets = Actuarial value of assets – PFB

$$\$14,800,000 = \$15,000,000 - \text{PFB}; \quad \text{PFB} = \$200,000$$

Reduced assets are greater than FT, so funding shortfall = \$0, and shortfall amortization charge = \$0, and MRC = TNC - (Reduced assets – FT)

$$\text{MRC} = \$2,000,000 - (\$14,800,000 - \$10,000,000)$$

The result of this equation is less than \$0, but since the MRC can never be reduced below \$0, the MRC in this question is deemed to be equal to \$0.

REVIEW QUESTIONS

- 1-1. For the 2008 plan year, the actuarial valuation date for all single-employer plans must be the first day of the plan year.

Is the above statement true or false?

- (A) True
(B) False

- 1-2. Funding standard carryover and prefunding balances:

| | 1/1/2010 | 1/1/2011 |
|------------------------------------|-------------|-------------|
| Funding standard carryover balance | \$5,500,000 | \$5,610,000 |
| Prefunding balance | \$5,000,000 | \$5,100,000 |

Selected valuation results:

| | 1/1/2010 | 1/1/2011 |
|------------------------------------|---------------|---------------|
| Funding target | \$100,000,000 | \$120,000,000 |
| Actuarial (market) value of assets | \$90,000,000 | \$100,000,000 |

Consider the following statement:

The funding standard carryover balance may be applied to the **minimum required contribution** for 2011.

Is the above statement true or false?

- (A) True
(B) False

- 1-3. Consider the following statements:

I. Both the prior year's funding standard carryover and prefunding balances must be subtracted from the prior year's actuarial value of assets to determine if the plan is in at-risk status for the current year.

II. Both the funding standard carryover and prefunding balances must be subtracted from the actuarial value of assets to determine if a plan is exempt from establishing a new shortfall amortization base when calculating the minimum required contribution.

III. Both the prior year's funding standard carryover balance and prefunding balance must be subtracted from the prior year's actuarial value of assets to determine if the current year's funding standard carryover and pre-funding balances may be used to reduce the current year's minimum required contribution.

Which, if any, of the above statement(s) is (are) true?

- (A) I only
(B) II only
(C) III only
(D) I, II, and III
(E) The correct answer is not given by (A), (B), (C), or (D) above.

1-4. The plan does not offer any accelerated benefit options

| | 1/1/2010 | 1/1/2011 |
|------------------------------------|-----------|-----------|
| Funding standard carryover balance | \$100,000 | \$100,000 |
| Prefunding balance | \$150,000 | \$300,000 |

Selected valuation results:

| | 1/1/2010 | 1/1/2011 |
|------------------------------------|-------------|-------------|
| Actuarial (market) value of assets | \$1,000,000 | \$1,250,000 |
| Funding target | \$1,000,000 | \$1,250,000 |

Consider the following statements for the 2011 plan year:

I. The funding standard carryover and prefunding balances can be used to reduce the minimum required contribution.

II. The plan is subject to quarterly contribution requirements.

III. The plan's funding shortfall is \$0.

Which, if any, of the above statement(s) is/are true?

(A) I and II only

(B) I and III only

(C) II and III only

(D) I, II, and III

(E) The correct answer is not given by (A), (B), (C), or (D) above

1-5. Funding standard carryover balance as of 1/1/2009: \$25,000.

Prefunding balance as of 1/1/2009: \$36,000.

Minimum required contribution for 2009: \$150,000.

Consider the following statement:

On 1/1/2009, the plan sponsor has the option of offsetting the minimum required contribution for the 2009 plan year by either the funding standard carryover balance or the prefunding balance.

Is the above statement true or false?

(A) True

(B) False

1-6. Plan effective date: 1/1/2000.

| | 1/1/2009 | 1/1/2010 |
|------------------------------------|--------------|--------------|
| Funding standard carryover balance | \$1,250,000 | \$1,325,000 |
| Prefunding balance | 950,000 | 1,100,000 |
| Selected valuation results: | | |
| Actuarial (market) value of assets | \$25,500,000 | \$32,600,000 |
| Funding target | 25,000,000 | 32,500,000 |

The plan sponsor elects to use the carryover balance and prefunding balance, to the extent available, to offset the minimum required contribution in 2010. The plan is not subject to the PPA transitional rule.

Consider the following statements:

- I. The plan sponsor may use the carryover balance toward the minimum funding requirement at 1/1/2010.
- II. The plan is exempt from establishing a shortfall amortization base as of 1/1/2010.
- III. The plan sponsor is subject to quarterly contribution requirements in 2010.

Which, if any, of the above statement(s) is (are) true?

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II, and III
- (E) The correct answer is not given by (A), (B), (C), or (D) above.

CHAPTER 2

FUNDING TARGET AND TARGET NORMAL COST

The definitions of FT and TNC both involve the present value of benefits as of the plan's valuation date. For the simple plan design that a candidate can expect to see on the exam, both values can be found by multiplying the participant's benefit amount by a present value factor. The FT benefit amount is the actual accrued benefit under the plan formula at the start of the plan year. The TNC benefit amount is the end of year benefit minus the beginning of year benefit used to calculate the FT. Since both the FT and TNC are determined *as of* the same date (the plan's valuation date), the present value factor is the same for both determinations.

DETERMINING BENEFITS

Typically, the primary benefit under a defined benefit plan described in an exam question will be expressed as a formula equal to a dollar amount or percentage of compensation (or average compensation, see the examples below) multiplied by a participant's years of service. In determining the plan benefits, compensation is limited under Code section 401(a)(17). Benefits are also limited to the maximum benefits under Code §415.

Knowledge of 401(a)(17) compensation limits and 415 benefit limits are included in the syllabus of exam EA-2L. These topics will not be covered in this book, but some answers to prior exam questions will hinge on these topics, and they will be explained in the solutions as a refresher of the EA-2L topics.

For the exam, the default provisions regarding such a benefit are that such benefit is a monthly life annuity beginning at the plan's Normal Retirement Age of 65, and that a participant enters the plan on date of hire (so that years of plan participation are equal to total years of service) and all years count for benefit service accrual. The questions also assume that the actuary in performing the plan valuation assumes these default provisions.

Keep in mind that for this purpose (as well as all other purposes on the exam) all of the default provisions may be changed, if such a change is implied or stated directly in the question. Of course, any exam question that specifies a change to the default provisions will include all information necessary to calculate the solution under the changed provisions.

IRS regulation 1.430(d)-1(d) contains rules regarding the amendment of provisions in a plan document, based on the amendment's adoption date and effective date. If an amendment is adopted prior to the plan's valuation date, and the effective date of such amendment is any time during the plan year, then the provisions of such amendment **MUST** be taken into account for purposes of determining the valuation FT and TNC. If an amendment is adopted after the plan valuation date, but no more than 2½ months after the end of the plan year, then the employer **MAY** (but is not required to) make a 412(d)(2) election (named for the Code section that permits such retroactive amendments) to apply such amendment in determining the plan's FT and TNC. One other condition is that the amendment's effective date must be no later than the first day of the plan year to qualify for the 412(d)(2) election.

If the 412(d)(2) election is not made, then the amendment is not considered in determining the FT and TNC. An amendment that is made more than 2½ months after the end of a plan year must

not be taken into consideration in determining FT and TNC, and an amendment that is effective after the end of the plan year is also not taken into consideration.

For all purposes in the above paragraph, an amendment cannot be considered to be effective if it is prohibited from taking effect due to AFTAP restrictions under Code §436(c). Rules regarding the AFTAP are discussed further in chapter 5.

EXAMPLES

Determine the benefit amount to be used for calculating the FT and TNC attributable to the participant described. In all cases, assume that the years given are years of service, years of plan participation, and years of service for benefit accrual. Compensation for benefit accrual is the compensation earned in the most recent year, there is no averaging of compensation over more than one year (this is not a usual plan provision, it is far more common in actual plans to see compensation averaged over a period of not less than 3 years, however, this is a quite common “shortcut” for averaging compensation on exam questions).

1. 1/1/2008 valuation. Benefit formula = 5% times compensation times years of service. Assumed salary scale = 4%. Participant has 2007 compensation of \$100,000, and 10 years of service on 1/1/2008.
2. 1/1/2009 valuation. Benefit formula = 5% times compensation times years of service, but the plan is amended during the plan year to increase the formula to 6% times compensation times years of service. The amendment is effective 1/1/09, and the employer makes the election under 412(d)(2) regarding the amendment. Assumed salary scale = 4%. Participant has 2008 compensation of \$100,000, and 10 years of service on 1/1/2009.
3. 1/1/2009 valuation. Benefit formula = 5% times compensation times years of service. Assumed salary scale = 4%. Participant has 2008 compensation of \$250,000, and 10 years of service on 1/1/2009.
4. 1/1/2009 valuation. Benefit formula = 10% times compensation times years of service. Assumed salary scale = 4%. Participant has 2008 compensation of \$200,000, and 2 years of service on 1/1/2009.
5. 1/1/2010 valuation. Benefit formula = \$50 per month times years of service. Participant has 2009 compensation of \$100,000, and 12 years of service on 1/1/2010.
6. 1/1/2010 valuation. Benefit formula = 50% of compensation at retirement age. Benefits are accrued on a fractional basis for all years of service. Participant has DOB = 1/1/1950; DOH = 1/1/1990; compensation of \$100,000.

SOLUTIONS

1. BOY benefit = $\$100,000 \times 5\% \times 10 = \$50,000$ annually
EOY benefit = $\$100,000 \times 1.04 \times 5\% \times 11 = \$57,200$ annually

For FT, the benefit to use is \$50,000/yr.

For TNC, the benefit to use is $\$57,200 - \$50,000 = \$7,200$ /yr.

Notice that part of the benefit increase is due to the additional year of service, part is due to the assumed increase in compensation. The assumed increase in compensation increases both the current year accrual, and the accrual that is attributable to service performed in the year's prior to the valuation date. However, all of the benefit increase is considered in determining the TNC,

and none of the increase is allocated to the FT benefit. This is mandatory under the definition of TNC in IRC §430(b).

2. Because the amendment was timely signed before the date 2½ months following the end of the plan year, and the employer made a 412(d)(2) election with regard to the amendment, the valuation may take this amendment into account for all purposes as if it were adopted on the first day of the plan year.

BOY benefit = $\$100,000 \times 6\% \times 10 = \$60,000$ annually

EOY benefit = $\$100,000 \times 1.04 \times 6\% \times 11 = \$68,640$ annually

For FT, the benefit to use is \$60,000/yr.

For TNC, the benefit to use is $\$68,640 - \$60,000 = \$8,640$ /yr.

The note about benefit increases in question 1 applies here as well, but the amendment, since it is recognized as being adopted at the start of the year, increases both the FT and TNC benefit. Also, the question data made no mention of the plan's AFTAP for 2008 or 2009, and so the default assumption is that there is no restriction preventing the adoption or application of the amendment.

3. The prior year compensation is greater than the §401(a)(17) dollar limit for both the prior and the current year. The considered compensation at the start of the plan year must be limited to the prior year maximum limit, and the assumed compensation at the end of the year must be limited to the current year's maximum.

BOY benefit = $\$230,000 \times 5\% \times 10 = \$115,000$ annually

EOY benefit = $\$245,000 \times 5\% \times 11 = \$134,750$ annually

For FT, the benefit to use is \$115,000/yr.

For TNC, the benefit to use is $\$134,750 - \$115,000 = \$19,750$ /yr.

Again, the increase in benefit that is attributable to the increase in considered compensation is included entirely in the TNC, even when the increase is due to a change by law to the 401(a)(17) compensation limit rather than a salary scale assumption.

4. By the plan formula:

BOY benefit = $\$200,000 \times 10\% \times 2 = \$40,000$ annually

EOY benefit = $\$208,000 \times 10\% \times 3 = \$62,400$ annually

However, the employee is limited to the 2009 maximum benefit under §415 for 2009 of \$195,000, reduced by one tenth for each year of participation less than 10. The §415 reduced benefits are:

BOY benefit = $\$195,000 \times 2 / 10 = \$39,000$ annually

EOY benefit = $\$195,000 \times 3 / 10 = \$58,500$ annually

For FT, the benefit to use is \$39,000/yr.

For TNC, the benefit to use is $\$58,500 - \$39,000 = \$19,500$ /yr.

In this case, there is no increase attributable to the increase in compensation, since both the BOY and EOY accrued benefit are limited by the §415 dollar limit and not by compensation. Also,

note that the 2009 dollar limit under §415 is applied to limit both the beginning and end of year accrued benefit, since both benefits represent benefits in 2009. The 2008 §415 limit is not used to limit the start of year benefit. Contrast this to the use of the 2008 compensation limit to reduce the benefit at the start of 2009 in question 3, since the start of year benefit is based on prior year compensation.

In this example, the benefit increase for TNC is equal to exactly 10% of the \$415 dollar limit, corresponding to the 10% of limit increase (from 20% to 30%) due to one additional year of service. This does not mean that the benefit for TNC can never be larger than 10% of the \$415 dollar limit. For example, if in this question, the plan formula yielded a BOY benefit of \$30,000 and an EOY benefit of \$50,000, the benefit increase used to calculate the TNC would be \$20,000. Since both the BOY and EOY benefits are less than the maximum benefit under §415, the fact that the increase is greater than 10% of the \$415 dollar limit is not an issue.

5. BOY benefit = $\$50 \times 12 = \600 monthly = \$7,200 annually
EOY benefit = $\$50 \times 13 = \650 monthly = \$7,800 annually

For FT, the benefit to use is \$7,200/yr.
For TNC, the benefit to use is $\$7,800 - \$7,200 = \$600$ /yr.

In this example, the participant's compensation is given, but is not needed (neither is an assumed salary scale, not provided in the question), since the benefits are not based on compensation. Exam questions may also give information that is not needed to solve the question. For this example, the monthly benefit was converted to an annual benefit, because exam questions typically provide information used to determine the present value factor with regard to an annual annuity amount, even though the annuity is assumed to be paid monthly.

6. Participant enters plan at age 40 (default assumption is Date of Hire = Date of Plan Entry). Normal retirement is at age 65 (default assumption), and the participant will have 25 years of service at this time (default assumption is that all years of service count for benefit accrual).

BOY benefit = $\$100,000 \times 50\% \times 20/25 = \$40,000$ annually
EOY benefit = $\$100,000 \times 50\% \times 21/25 = \$42,000$ annually

For FT, the benefit to use is \$40,000/yr.
For TNC, the benefit to use is $\$42,000 - \$40,000 = \$2,000$ /yr.

A specific salary scale provision is not provided in the question data, and so it must be assumed that there is no salary scale used on the valuation. This example shows how the default assumptions can allow a test question to be valid even with a minimum of data provided. This example also shows that knowledge of allowable accrual methods under ERISA (the fractional method in this example) are covered on the EA-2L exam and knowledge of them is presumed for this exam.

PRESENT VALUE FACTORS

The present value factor is determined using a combination of three “segment” interest rates. Benefits expected to be paid within five years of the plan’s *valuation date* are determined using the first segment interest rate. Benefits expected to be paid within the next fifteen years (five to twenty years after the valuation date) are determined using the second segment interest rate. And benefits expected to be paid at any time thereafter (more than 20 years after the valuation date) are determined using the third segment interest rate.

You should notice that in cases where no benefits are scheduled to be paid less than 20 years in the future, only the third segment interest rate will be used. This type of situation greatly reduces the number of manual calculations required to compute a present value factor, and is often used on actual exam questions to simplify the results. See questions 7. a. and 8. a. below for examples of this situation.

Notice that these rates are not cumulative, as might be expected in other areas of actuarial practice. For example, to determine the present value of a benefit payment 15 years in the future, the payment is not discounted at the second segment interest rate for ten years, and then at the first segment rate for the remaining five years. The entire discount is at the second segment rate for the entire 15 years.

Also, note that the interest rates used to value payments are determined based on the length of time from the calculation date (the valuation date) and not with regard to the payment start date. For example, if a participant is age 63 on the valuation date and benefits are to begin at age 65, the payments valued at the first interest rate are the annuity payments expected to be made from age 65 to 68 of the participant, not from age 65 to 70.

Prior to the 2014 examination, exam questions would frequently ask candidates to calculate a present value factor using commutation functions given within the question. Beginning with the 2014 exam, however, the materials provided at the start of the exam included lists of commutation functions for ages 60 to 85 at different interest rates for both male and female plan participants. The tables for the exam are published in the JBEA Examination Program Booklet.

The tables remained unchanged from 2014 to 2016 and then changed in 2017. All of the examples below, and the questions on the exams reproduced in this book, are based on these tables which are reproduced at the end of this book. The tables included in the 2018 Examination Booklet have not changed from 2017. You should download the booklet to become familiar with the changes in the new tables for 2018.

The tables provided for the exam are split into Male and Female tables. Generally, plans may not discriminate in favor of either men or women. For example, a lump sum distribution from the plan is calculated using a unisex table (defined in Code §417(e)) so that the payment is the same whether the participant is male or female. However, for purposes of funding, plans may and in most cases are required to use gender specific tables to calculate present value factors for determining the FT and TNC (small plans are permitted to use unisex tables for funding).

If an exam question specifies that a participant is either male or female, the question is probably directing you to use these provided mortality tables. Otherwise, there would be no need to specify the gender of the participant.

The following examples will give you some practice using the tables. For all examples, the valuation segment rates are 5%, 6%, and 7%. Additional information for ages under 60 is given.

PRESENT VALUE CALCULATIONS

7. For purposes of the valuation, the actuary assumes that all participants will work to age 65, and then receive their benefits as a monthly annuity beginning at age 65. There is a pre-retirement death decrement, but no other decrements prior to retirement age 65. Calculate the present value of the future annuity payment on this valuation for a Male participant whose age on the valuation date is:
 - a. 40 $D_{40|5\%} = 140,634$ $D_{40|6\%} = 96,256$ $D_{40|7\%} = 66,117$
 - b. 55 $D_{55|5\%} = 66,504$ $D_{55|6\%} = 39,485$ $D_{55|7\%} = 23,559$
 - c. 62
 - d. 65

8. Assume a valuation with the same assumptions as question 7, but this time with no pre-retirement death decrement, or pre-retirement increments of any other kind. How does this affect the present value factor for a Male participant at the age:
 - a. 40 $D_{40|5\%} = 140,634$ $D_{40|6\%} = 96,256$ $D_{40|7\%} = 66,117$
 - b. 55 $D_{55|5\%} = 66,504$ $D_{55|6\%} = 39,485$ $D_{55|7\%} = 23,559$
 - c. 62
 - d. 65

Notice the difference in the techniques to calculate a present value factor in questions 7 and 8. Questions on the exam will frequently state that the valuation either does or does not include a pre-retirement mortality assumption. Therefore, it is important that you understand and be able to apply both methods.

SOLUTIONS

7. a. Every payment to this participant is more than 20 years in the future, so all calculations are done using the third segment rate commutation factors. The payments begin at age 65, so the formula is simply:

$$N_{65}^{(12)} / D_{40} = 116,056 / 66,117 = 1.7553$$

b. Payments from age 65 to 75 are valued at the second segment rate, and those after 75 are valued at the third segment rate:

$$6\%: (N_{65}^{(12)} - N_{75}^{(12)}) / D_{55} = (230,685 - 79,878) / 39,485 = 3.8193$$

$$7\%: N_{75}^{(12)} / D_{55} = 37,386 / 23,559 = 1.5869$$

$$\text{Present value factor} = 3.8193 + 1.5869 = 5.4062$$

c. Payments from age 65 to 67 are valued using the first segment interest rate, payments from age 67 to 82 are valued using the second segment interest rate, and payments after age 82 are valued using the third segment interest rate, as follows:

$$5\%: (N_{65}^{(12)} - N_{67}^{(12)}) / D_{62} = (463,348 - 389,761) / 45,973 = 1.6007$$

$$6\%: (N_{67}^{(12)} - N_{82}^{(12)}) / D_{62} = (191,293 - 28,104) / 25,543 = 6.3888$$

$$7\%: N_{82}^{(12)} / D_{62} = 12,501 / 14,271 = 0.8760$$

$$\text{Present value factor} = 1.6007 + 6.3888 + 0.8760 = 8.8655$$

d. Payments from age 65 to 70 are valued using the first segment interest rate, payments from age 70 to 85 are valued using the second segment interest rate, and payments after age 85 are valued using the third segment interest rate, as follows:

$$5\%: (N_{65}^{(12)} - N_{70}^{(12)}) / D_{65} = (463,348 - 294,765) / 38,875 = 4.3365$$

$$6\%: (N_{70}^{(12)} - N_{85}^{(12)}) / D_{65} = (141,617 - 15,698) / 20,994 = 5.9979$$

$$7\%: N_{85}^{(12)} / D_{65} = 6,827 / 11,403 = 0.5987$$

$$\text{Present value factor} = 4.3365 + 5.9979 + 0.5987 = 10.9331$$

8. The above calculations are changed by the fact that the D_x factors at current age are no longer relevant to the calculation, since there is no pre-retirement mortality considered. Instead, the annuity purchase rate is determined at the annuity start date using the D_r factor at assumed retirement age of 65. The age 65 present value factors are then reduced by interest only (using the appropriate segment rate) to the participant's age on the current valuation. The revised calculations are as follows:

a. Again, only the third segment rate is considered, since no benefit payment occurs less than 20 years after the valuation date:

$$7\%: N_{65}^{(12)} / D_{65} / 1.07^{25} = 116,056 / 11,403 / 1.07^{25} = 1.8752$$

$$b. 6\%: (N_{65}^{(12)} - N_{75}^{(12)}) / D_{65} / 1.06^{10} = (230,685 - 79,878) / 20,994 / 1.06^{10} = 4.0111$$

$$7\%: N_{75}^{(12)} / D_{65} / 1.07^{10} = 37,386 / 11,403 / 1.07^{10} = 1.6667$$

$$\text{Present value factor} = 4.0111 + 1.6667 = 5.6778$$

$$c. 5\%: (N_{65}^{(12)} - N_{67}^{(12)}) / D_{65} / 1.05^3 = (463,348 - 389,761) / 38,875 / 1.05^3 = 1.6352$$

$$6\%: (N_{67}^{(12)} - N_{82}^{(12)}) / D_{65} / 1.06^3 = (191,293 - 28,104) / 20,994 / 1.06^3 = 6.5265$$

$$7\%: N_{82}^{(12)} / D_{65} / 1.07^3 = 12,501 / 11,403 / 1.07^3 = 0.8949$$

$$\text{Present value factor} = 1.6352 + 6.5265 + 0.8949 = 9.0566$$

d. Because the participant has already reached age 65 in question d., there is no pre-retirement decrement of any kind to be modified from the prior question 7. Therefore, the present value factor in situation d. of question 8 is the same as the answer in part d. of question 7.

As expected in answers a through c, the present value is greater in the example that does not include the decrement for pre-retirement death. This is equivalent to the difference between a plan that provides no benefit in the event that a participant dies prior to the annuity starting date and a plan that provides a beneficiary payment equal to the actuarial equivalent of the future annuity, with the value of the benefit of the second plan clearly being more valuable.

USING BENEFITS AND PV FACTORS TO DETERMINE FT AND TNC

After the techniques above are used for valuing benefits and present value factors, the actual FT and TNC generated by a single participant can be found by simply multiplying the benefit by the present value factor.

9. Assume the participant in question 1 above is 40 years old, and the benefit present value is calculated according to the method in question 8. Determine the FT and the TNC for this participant.

Frequently, an exam question will ask you to determine a FT and/or a TNC based on a weighted average of more than one retirement scenario with a defined probability,

10. Assume the same facts as in question 9, except that not all participants are assumed to work to age 65. Instead, an employee can elect an early retirement at age 63 or 64 with a 6% reduction in benefits per year actual retirement precedes normal retirement. It is assumed that 40% of participants will take early retirement at age 63, and 40% of those remaining will retire at age 64. The remainder will retire at age 65. Calculate the FT and TNC for the same 40 year old participant.

SOLUTIONS

9. From question 1, the benefit at the start of the year is \$50,000, and the benefit increase for the year is \$7,200. From question 8 above, the present value factor for a 40 year old participant is 1.8752. For this participant, the valuation FT and TNC are:

$$\text{FT: } \$50,000 \times 1.8752 = \$93,760$$

$$\text{TNC: } \$7,200 \times 1.8752 = \$13,501$$

10. Both the BOY accrued benefit and the increase in benefit for the year are reduced by 6% per year. The FT and TNC are determined assuming a retirement at age 63 and 64 in the same way the numbers above were calculated for age 65:

$$\text{Age 64: BOY accrued benefit} = \$50,000 \times (1 - .06 \times 1) = \$47,000$$

$$\text{Expected increase in accrued benefit} = \$7,200 \times (1 - .06 \times 1) = \$6,768$$

$$\text{PV Factor: } N_{64}^{(12)} / D_{64} / 1.07^{24} = 127,945 / 12,301 / 1.07^{24} = 2.0506$$

$$\text{FT: } \$47,000 \times 2.0506 = \$96,378$$

$$\text{TNC: } \$6,768 \times 2.0506 = \$13,878$$

$$\text{Age 63: BOY accrued benefit} = \$50,000 \times (1 - .06 \times 2) = \$44,000$$

$$\text{Expected increase in accrued benefit} = \$7,200 \times (1 - .06 \times 2) = \$6,336$$

$$\text{PV Factor: } N_{63}^{(12)} / D_{63} / 1.07^{23} = 140,764 / 13,257 / 1.07^{23} = 2.2399$$

$$\text{FT: } \$44,000 \times 2.2399 = \$98,556$$

$$\text{TNC: } \$6,336 \times 2.2399 = \$14,192$$

From the data given in the question, the employee has a 40% chance of retiring at age 63, a $(1 - .40) \times .40 = 24\%$ chance of retiring at age 64, and a $(1 - .40) \times (1 - .40) \times 1.00 = 36\%$ chance of retiring at age 65. Weighting the above amounts by these probabilities provides the following calculations:

$$\text{FT: } (\$98,556 \times 40\%) + (\$96,378 \times 24\%) + (\$93,760 \times 36\%) = \$96,307.$$

$$\text{TNC: } (\$14,192 \times 40\%) + (\$13,878 \times 24\%) + (\$13,501 \times 36\%) = \$13,868.$$

This example is a fair representation of the type of question which has been asked on past exams. You can see that the large number of calculations required for this type of problem would cause this question to take some time under exam conditions, and thus could be expected to be assigned

a high point value on the exam. You can also see how the use of a participant who is more than 20 years from receiving his first benefit payment means that only the third segment interest rate is used, and this greatly reduces the number of calculations that would otherwise be required to solve this problem.

EFFECTIVE INTEREST RATE (EIR)

Effective Interest Rate is a term defined in IRC §430(h)(2)(A) as the single interest rate which, if it were applied at all time periods, would produce the same FT as the three segment rates. The term will be used throughout the book interchangeably with the abbreviation EIR. The EIR can be thought of as a weighted average of the three segment rates. By definition, the EIR must be no less than the lowest of the three segment interest rates, and no greater than the largest segment rate.

EXAMPLE

Suppose a plan has only two participants, each expected to be paid a single lump sum payment in the future. For purposes of computing the FT, Participant 1 will receive a payment of \$250,000 three years after the valuation date, and Participant 2 will receive \$50,000 on a date 22 years after the valuation date. The three segment interest rates are 5%, 6%, and 7%.

The funding target is calculated as $(\$250,000 / 1.05^3) + (\$50,000 / 1.07^{22}) = \$227,245$. The effective interest rate is the interest rate which could replace both 5% and 7% in the previous equation and produce the same result. That is, $(\$250,000 / (1+EIR)^3) + (\$50,000 / (1+EIR)^{22}) = \$227,245$. Using either algebraic techniques or simple trial and error will allow you to produce the result $EIR = 5.61\%$ (Note, the EIR is always rounded to the nearest hundredth of one percent).

Obviously, the calculations for EIR can become quite extensive in the case of annuity payments and plans with hundreds or thousands of participants, rather than two. Such effective interest rate determinations can only be performed using computer software designed for such a task, and any questions regarding EIR on the exam will be restricted to simple examples such as the one above.

SEGMENT INTEREST RATES

As mentioned above, the three segment interest rates are the rates for benefits due within five years, in five to twenty years, and over twenty years. The rates are based on rates actually being paid on high grade corporate bonds for each of these three periods. These rates can and do change from month to month. Each month, the IRS will release segment interest rates for that month, as well as a 24-month average of such rates. The current rates are used to determine the value of lump sum benefits under 417(e) (this topic is tested on the EA-2L exam), and the 24 month average of such rates produce the three segment rates that are used for funding.

For funding purposes – in other word, to determine the FT and TNC – the plan sponsor is permitted to use the 24 month average interest rates for the month in which the plan valuation occurs, or for any of the four months prior to that month. The month to be used is stated in the written plan document. Once selected, the choice of month to use is a part of the plan's "funding method" and may only be changed with the permission of the IRS.

A plan sponsor may also elect to use a full yield curve, rather than the three segment rates. Under the full yield curve, the IRS publishes a separate interest rate for each year and half year, and

every future benefit expected to be paid is reduced by the interest rate corresponding to the expected payment date. Because of the large number of calculations that would be required in using the full yield curve for a plan with a large number of participants, (the PPA law anticipates it would only be used with computer software), exam questions will typically use the segment rates only. Be aware, however, that the yield curve is an option allowed under PPA.

When PPA was passed, it was reasonable to assume that the three segment rates might hover around 5%, 6%, and 7%. After the stock market drop in 2008, however, the nation entered a period of much lower interest rates, with segments of around 1.5%, 3.5%, and 4.5% becoming much more common.

Lower interest rates produced higher mandatory funding contributions – since contributions can be expected to earn less in future years, the contributions themselves must be larger to meet funding targets. In order to ease the financial burden of larger contributions on plan sponsors (so that sponsors would not be encouraged to terminate their defined benefit plans), Congress modified PPA, starting in the 2012 funding year, to allow FT and TNC to be calculated with higher interest rates, producing lower present values for funding.

Congress changed the way segment rates for producing FT and TNC are calculated when it passed the Moving Ahead for Progress in the 21st Century Act (MAP-21). Later, Congress modified the rules again with the Highway and Transportation Funding Act (HATFA). The changes made by these two laws are discussed in more detail in Chapter 6.

In simplified terms, the effect of these two laws is to create a second set of three segment interest rates to be used on actuarial valuations. This new set of segment interest rates (called “adjusted” interest rates under the law and on the exam) produces a smaller FT and TNC for calculating mandatory minimum plan contributions. The segment rates calculated under the unmodified terms of PPA produce a larger FT and TNC, and these values are used to determine the maximum deductible contribution amounts each plan year. Examples in Chapter 6 will demonstrate the actual effects of the MAP-21 and HATFA law changes.