
SOCIETY OF ACTUARIES
Retirement Benefits United States – Design & Pricing

Exam DP-RU

Date: Thursday, November 1, 2012

Time: 8:30 a.m. – 12:15 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 70 points.

This exam consists of 8 questions, numbered 1 through 8.

The points for each question are indicated at the beginning of the question. Questions 1, and 3 pertain to the Case Study, which is enclosed inside the front cover of this exam booklet.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate Exam DP-RU.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

CASE STUDY INSTRUCTIONS

The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.

****BEGINNING OF EXAMINATION****

Question 1 pertains to the Case Study.

- 1.** (7 points) You are the actuary for NOC's Full-Time Salaried and Union Retiree Health Benefit Program.
 - (a) (2 points) Identify the data elements needed to complete the January 1, 2013 actuarial valuation, including the development of the per capita claims cost assumption.
 - (b) (5 points) Describe the process and the considerations:
 - (i) To ensure data quality.
 - (ii) To determine the per capita claims cost assumption.

2. (11 points)

- (a) (2 points) Describe the characteristics of the two (2) categories of pension plan embedded options.
- (b) (3 points) Describe the embedded options under each of the following retirement programs:
- (i) A floor-offset plan.
 - (ii) A defined benefit pension plan with cost of living adjustments based on the change in the Consumer Price Index (CPI), with a floor of 1% and a cap of 6% per year.
 - (iii) A defined benefit pension plan with cost of living adjustments that provides pension increases if the prior year's rate of return on plan assets exceeds a "hurdle rate" of 8% per year.
- (c) (3 points) You are given the following for a floor-offset pension plan:

Plan Provisions:

Retirement Benefits:	Greater of:
	(i) 1.0% of final year's earnings times years of service, and
	(ii) Annuitized Defined Contribution (DC) account balance at Normal Retirement Age
Normal Form of Benefit Payment:	Life only, payable monthly in advance
Normal Retirement Age:	Age 65

Participant Data as of January 1, 2012:

	Employee A	Employee B
Retirement Age:	65	65
Service:	5 years	20 years
2011 Salary:	\$60,000	\$90,000
Defined Contribution Balance:	\$50,000	\$185,000

Annuity factor:

$\ddot{a}_{65} : 15.0$

Determine the additional cost to the employer of the embedded options as of January 1, 2012 for the plan.

Show all work.

2. Continued

- (d) (3 points) You are the actuary for a company that sponsors a defined benefit pension plan that provides annual post-retirement indexing of 50% of the increase in CPI during the previous calendar year.

For actuarial valuation purposes, the current CPI increase assumption is 2.5% per year.

During collective bargaining negotiations, the union requested amending the plan to provide minimum post-retirement indexing of 0.5% per year, arguing that there is no additional cost to the company.

Evaluate the union's argument.

Question 3 pertains to the Case Study.

- 3.** (11 points) You are the actuary for the NOC pension and retiree medical plans. NOC has hired you to perform an experience study.
- (a) (1 point) List the steps to perform an experience study for pension and retiree medical plans.
- (b) (5 points) Describe the considerations when performing an experience study for the following assumptions for NOC's defined benefit pension and retiree medical plans:
- (i) Retirement.
 - (ii) Turnover.
 - (iii) Mortality.
 - (iv) Trend rates.
- (c) (3 points) Based on the results of your experience study for the Full-Time Salaried Pension Plan, you have recommended the following assumption changes:
- Salary Scale:
Under age 35: 6% per year
Age 35 and over: unchanged
- Turnover:
Under 10 years of service: 10% higher than current turnover assumption
Other members: unchanged
- Retirement Age:
Age 64
- Describe, in words, the impact of each assumption change to the January 1, 2012 pension valuation results for the Full-Time Salaried Pension Plan.
- (d) (2 points) Describe, in words, the difference in sensitivity of the liabilities to the above assumption changes between the Full-Time Salaried Pension Plan and the Full-Time Salaried and Union Retiree Health Benefit Program.

4. (9 points) Your client sponsors a defined benefit pension plan where three participants have recently retired under different phased retirement arrangements.

You are given the following information for the three participants:

Participant	Type of Arrangements
A	Elected to commence partial pension payments and is continuing to work for your client on a part-time basis
B	Elected to commence full pension payments and is continuing to work for your client on a full-time basis
C	Elected to commence full pension payments and has been hired by your client as an independent contractor

Describe the benefits and the challenges of each arrangement from both the employees' and employer's perspective.

5. (7 points)

- (a) (2 points) Identify four temporary regulatory changes Organization for Economic Co-operation and Development (OECD) countries have used to address defined benefit funding challenges as a result of recent financial crises. References to specific countries are not required.
- (b) (5 points) For the following three (3) counter-cyclical regulatory concepts, describe how each improves both the sustainability and security of defined benefit plans in the future:
 - (i) Avoid excessive reliance on current market values for purposes of determining contributions (i.e. permit smoothing techniques).
 - (ii) Allow appropriate levels of over-funding in good economic times via more flexible tax ceilings.
 - (iii) Flexible funding rules that reflect overall volatility of funding valuations.

6. (10 points) The CFO of ABC Company is looking for ways to reduce the contribution volatility of its traditional defined benefit pension plan. The CFO has hired you to explore design options that keep the guaranteed structure of a defined benefit plan but reduce overall volatility.

(a) (3 points) Describe how eliminating the following plan provisions could help achieve the CFO's objectives:

- (i) Lump sums.
- (ii) Early retirement.

(b) (7 points) The CFO's concern about volatility relate to the following risks:

- Investment;
- Interest rate; and
- Longevity.

Explain how the design features of each of the following two defined benefit pension plans could address each of the above risks:

- (i) Retirement Shares Plan (RSP).
- (ii) Cash balance plan.

7. (9 points) Your client is establishing a nonqualified defined benefit pension plan for its highly paid executives to supplement the current qualified defined benefit plan. The client's key objectives are:

- Cost containment;
- Benefit adequacy; and
- Retention and attraction.

(a) (3 points) Compare and contrast how the following two Supplemental Executive Retirement Plan (SERP) designs could address your client's objectives:

- (i) A plan that restores benefits above government limits.
- (ii) A plan that provides a fixed percentage of final pay at retirement.

(b) (3 points) You are given the following for two members with individual executive pension arrangements:

Participant Data as of January 1, 2012:

	<u>Employee A</u>	<u>Employee B</u>
Age:	55	50
Service:	8 years	12 years
2011 Base Pay:	\$500,000	\$250,000
2011 Bonus:	\$100,000	\$25,000
Pay Increase Timing:	Beginning of year	Beginning of year
Bonus Timing:	End of year	End of year
Assumed Base Pay Increase:	5% per year	4% per year
Target Bonus:	20% of base pay	10% of base pay

Plan Provisions:

	<u>Employee A</u>	<u>Employee B</u>
Pay Definition:	Base	Base + Bonus
Normal Retirement Age:	62	65
Final Average Pay (FAP):	3-year average	5-year average
Benefit Formula:	$4\% \times \text{FAP} \times$ Min (Service, 10) PLUS $7\% \times \text{FAP} \times$ Max(Service - 10, 0)	$2\% \times \text{FAP} \times$ Service

Calculate the replacement ratio at their Normal Retirement Age assuming they are fully vested.

Show all work.

(c) (3 points) Evaluate each plan design in (b) based on your client's objectives.

8. (6 points) You are given the following:

Year	Cash Flow (end of year)	Spot rate
5	200	1%
9	300	2%
12	500	3%
16	600	4%

- (a) (3 points) Calculate the duration. Show all work.
- (b) (1 point) A pension plan has a liability of \$100,000,000 with a duration of 8. Calculate the estimated liability after a 50 basis point increase in the discount rate, using duration techniques.
- Show all work.
- (c) (2 points) Discuss the appropriateness of estimating the revised liability using duration for a 200 basis point change in the discount rate.

****END OF EXAMINATION****

USE THIS PAGE FOR YOUR SCRATCH WORK