DP-RU Model Solutions
Spring 2013

1. Learning Objectives:

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

11. The candidate will be able to apply standards of practice and the guides to professional conduct.

Learning Outcomes:

(5c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding and asset valuation methods.

(11d) Explain and apply all of the applicable standards of practice related to valuing retirement obligations.

Sources:

R-D808-11 - ASOP 44, Selection and Use of Asset Valuation Methods for pension Valuations

Commentary on Question:

In this question, candidates were asked to describe the considerations in choosing an asset valuation method and then evaluate the appropriateness of a sample asset method under the appropriate actuarial standards of practice.

Solution:

(a) Describe the considerations in choosing an asset valuation method.

Commentary on Question:

Part (a) came directly from a section in ASOP 44. Section 3.2 in ASOP 44 is called "Considerations in selecting a method." If candidates realized this, they did well on this part of the question, as it was a straight recall-type list. Points were also given for realizing that there is an ASOP that covers asset valuation methods.

Follow ASOP 44 – describes selection and use of asset methods
Purpose of measurement – what will the asset method be used for – funding? Accounting?
Objectives of the client – reduce volatility in contribution levels? Fund to a certain percentage of liability?

1. Continued

Multiple methods for different classes of assets – for example, smoothing for equity, market value for bonds

Timing – any adjustments needed between "as of" date and measurement date?
Use of actuarial assumptions – follow ASOPs 27 and 35, make sure assumptions are consistent with other assumptions used in the actuarial valuation
Other considerations - plan's investment policy, characteristics of asset classes in plan's assets, expected cash flow and liquidity needs, period of time over which assets are expected to be held, characteristics of methods used to measure the pension obligation

(b) Given the company's objective, evaluate the appropriateness under actuarial standards of practice of adopting the proposed asset valuation method, including any issues that should be addressed.

Commentary on Question:
In this section, candidates were asked to evaluate the proposed asset method under actuarial standards of practice, as well as to point out any issues to be addressed. Section 3.3 of ASOP 44 covers the use of asset methods other than market value, and the well-prepared candidate used that section as a framework under which to evaluate the proposed asset method.

Smoothing over 4 years – may be too long a period. Not even permissible under PPA, which limits to 2 years.

Even if this plan is not subject to PPA, the length of the smoothing period should be addressed, so that differences between the actuarial value and the market value are recognized within a reasonable period of time.

The use of a corridor may be warranted.

Expected return of 8% used to calculate deferred gains/losses – 8% is likely too high. This assumption should be analyzed to see if it supportable, and should be changed if it is not.

Mid-year cash flow assumption – this may not be reasonable for contributions, and/or lump sum payments. May be better to use actual cash flow timing.

2. Learning Objectives:

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

Learning Outcomes:

(1d) Given a plan type, explain the relevance and range of plan features including the following:
- (i) Plan eligibility requirements
- (ii) Benefit eligibility requirements, accrual, vest and phased retirement
- (iii) Benefit/contribution formula
- (iv) Payment options and associated adjustments to the amount of benefit
- (v) Ancillary benefits
- (vi) Benefit subsidies and their value, vested or non-vested
- (vii) Participant investment options
- (viii) Required and optional employee contributions
- (ix) Phased retirement and DROP plans

Sources:

OECD paper: Evaluating the Design of Private Pension Plans: Costs and Benefits of Risk Sharing, D-140-11

Commentary on Question:

The question was testing candidates understanding of the risk sharing characteristics of various pension plans and the trade-off between the uncertainty of benefits and the uncertainty of contributions in the design of sustainable pension plans.

Candidates appeared to have difficulty identifying the source of the material relating to this question and as such did not provide an answer based on replacement rates and replacement ratios.

Solution:

(a) Describe the two main approaches to managing intergenerational risks in pension plans.

The two main approaches to managing intergenerational risks:
1. Pension plans collectively organize risk sharing by redistributing the risks between various stakeholders; and
2. Pension plans use hedging solutions via financial markets, e.g. buy hedges or reinsure risks.

(b) Compare and contrast the intergenerational risk sharing characteristics of the following three plans from the employees' and employer's perspective.

(i) Career average defined benefit plan with conditional indexation.

2. Continued

(ii) Defined benefit plan where employee and employer contribution rates are fixed but benefits and indexation are linked to funded status ("Collective Defined Contribution Plan").

(iii) Hybrid plan.

Evaluation of the intergenerational risk sharing characteristics is based on two performance criterion:

1. Funding ratios – the ratio of plan assets to liabilities; and
2. Replacement rates – the ratio of pensioner's benefit at retirement relative to final wage.

(i) Narrowest range of replacement rates of the three plans and largest range of funding ratios of the three plans.

(ii) Largest range of replacement rates of the three plans and narrowest range of funding ratios of the three plans.

(iii) Moderate range of outcomes for replacement rates and funding ratios.

(c) Recommend the pension plan design in (b) that will provide the greatest potential for sustainable risk sharing among plan members. Justify your answer.

The hybrid plan provides the greatest potential for sustainable risk sharing among plan members. Simulations indicate that hybrid plans offer positive outcomes for level and predictability of replacement rates with less negative outcomes for higher contribution rates.

3. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6e) Describe and apply the building of economic assumptions.

Sources:

Yamamoto Chapter 9 pp. 262-267

Society of Actuaries Long Term Healthcare Trends Resource Model Practical Issues for Actuaries

Modeling Long Term Healthcare Cost Trends, Getzen

Commentary on Question:

In this question, candidates were asked to demonstrate not only their understanding of the input parameters used in the long term healthcare trends resource model but also how to use the model for changing environments. A well-prepared candidate would have been able to identify the model input parameters and demonstrate an understanding of which inputs would need to be modified under certain scenarios.

For part (a), a well-prepared candidate would have been able to describe the five input parameters required by the model to project annual growth in medical costs along with the two optional parameters that can be used to place limitations/restrictions on the growth of medical cost and change the shape of future trends.

For part (b), a well-prepared candidate would have been able to describe the modifications required to the input parameters under each of the two scenarios.

Most candidates performed well on part (a) of the question. For part (b), some candidates did not describe the specific input parameters that would be modified and whether the trend would increase or decrease as a result of these modifications.

Solution:

(a) Describe the input parameters required by the Society of Actuaries' Long Term Healthcare Trend Resource Model

Five input parameters are required by the model to project annual growth in medical costs:

1. Rate of Inflation
    - Ordinary increase in prices
    - Measured by the GDP deflator (obtained by dividing nominal GDP by real GDP) and set for year 2000 base
    - Baseline 3.2% (range 1.5% - 5.5%)

3. Continued

2. Rate of Growth in Real Income/GDP Per Capita
    - Growth in real per capita income is the major driver of increasing health care costs
    - Baseline 1.9% (range 0.8% - 3%)
3. Income Elasticity Multiplier
    - Income effect on medical demand and labor cost
    - Use of an income elasticity multiplier less than 1.0 would imply a shrinking share of spending on health as nation became wealthier and clearly counter-factual.
    - U.S. has had significantly higher elasticity and analysts would argue that rapid growth in US due more to stronger desire to use latest technology than to income effects.
    - Baseline 1.4 (range 1.0 - 1.6)
4. Technology Trend (excess)
    - Extra increase due to technology and other factors
    - Combined (income + technology) effects ought to be consistent with actual rates of "excess" growth above incomes/wages in prior years
    - Baseline 1.2% (range 0.0% - 2.5%)
5. 2011 Baseline Health Share of GDP
    - Baseline estimate for the share of GDP spent on health is almost identical to the 17.49% provided in the most recent CMS projection
    - Baseline 17.5%

There are two optional parameters that can be used to place limitations/restrictions on the growth of medical cost and change the shape of future trends.

1. Resistance Point
    - Rate of increase in medical costs cannot continue indefinitely to exceed the rate of growth in per capita income without facing logical contradiction of spending more than 100% GDP
    - Baseline set at 25%
2. Limit Year
    - Year for limiting medical cost growth to growth in per capita income

Other Parameters

1. Change Parameter Values in 2020-2030 and 2030+
2. Change Short-Run Annual %'s
3. Baseline $ Per Person Medical Costs

3. Continued

(b) Describe modifications to the input parameters under the following scenarios:

(i) Increase in future co-pays and deductibles paid by the retiree.

(ii) Medical advancements which significantly increase drug costs.

Increase in future co-pays and deductibles paid by the retiree.

- Projecting trend will be below the baseline if the fraction of total costs paid for through co-pays and deductibles is rising
- Reduction in annual growth could be applied to the model by changing the "excess growth rate" (technology) input
- With a lower rate of growth rate assumption, the percentage of GDP resistance point would be reached later than under the baseline

Medical break-through which significantly increases drug costs

- May increase income elasticity to show increase in medical spending
- May assume a higher technology trend (excess) input assumption
- Projecting trend will be higher than the baseline
- Will result in overall healthcare trend rate assumption reaching resistance point earlier

4. Learning Objectives:

4. The candidate will understand alternative plan types that occur internationally.

Learning Outcomes:

(4b) Give examples of the structure of different plan types.

Sources:

R-D140-11: Private Pensions: Alternative Approaches Could Address Retirement Risks Faced by Workers but Pose Payoffs, pp.1-38

McGill et al, *Fundamentals of Private Pension*s, 9th Edition, 2010, Chapter 11

Morneau Sobeco, *Handbook of Canadian Pension and Benefit Plans,*14th edition, 2008, Chapter 12

Commentary on Question:

This question expected candidates to be able to describe four risks faced in retirement and explain how those risks could be mitigated by changes in plan design. In part (a), since the four risks were provided in the question, a fully correct solution provided extra details beyond just defining the risk. In part (b), each plan design feature could be changed in at least one way to mitigate one or more of the risks from part (a).

Solution:

(a) Describe the following risks in accumulating and preserving defined contribution retirement savings faced by employees:

(i) Contributions.

(ii) Leakage.

(iii) Fees.

(iv) Drawdown of benefits.

Commentary on Question:

Many candidates did a good job defining each of the four risks, but in general, the descriptions were lacking in supporting information.

The first risk is that contributions may not be adequate to accumulate a sufficient benefit. This is especially seen in workers who are young or have low income levels. This risk is magnified when the failure to make an employee contribution also results in the failure to receive any matching employer contributions.

4. Continued

The second risk, leakage, has to do with employees failing to accumulate a sufficient retirement benefit because of their early access to funds. For example, they may take loans and fail to repay them, or they may take hardship withdrawals, or they may cash out their benefit when they change jobs.

The third risk is that high fees will eat into the earnings from the account balance. Employees typically bear investment fees, and in many cases, also pay administrative fees. These lower the annual return, resulting in smaller balances at retirement.

Finally, since DC benefits are usually paid as a lump sum, there are risks associated with the asset drawdown. First, there is longevity risk, which means the retiree might outlive his or her account balance. Next, there is investment risk, meaning the retiree is exposed to a decline in assets if investment return is poor. Lastly, there is inflation risk, which means inflation could diminish the purchasing power of a retiree's benefit.

(b) You are given the following plan design:

- Employee contributions: voluntary up to 10% of base pay
- Employer contributions: 3% of base pay plus 100% matching on employee contributions up to 3% of base pay
- Investment options: range of 25 different funds in various asset classes
- Employee loans: permitted without restriction
- Form of distribution: lump sum

Propose changes to the plan design to help mitigate the risks described in (a).

Commentary on Question:
Candidates, in general, provided changes that would mitigate the risks in part (a). However, few suggested changes to all of the listed plan design features. Also, many failed to directly link the proposed change to a specific risk from part (a).

Proposed change to EE contributions: First, automatically enroll employees at a certain level (e.g., 3%) and automatically escalate the contribution percentage (e.g., 1% per year for the first three years). This is a good idea because auto enrollment and auto escalation have been shown to increase participation rates. Another possibility is to include bonus and/or overtime pay in the definition of eligible earnings. These changes combat the Contribution risk.

Proposed change to ER contributions: Could increase the ER match or the EE contribution necessary to get the full ER match. This would encourage higher contribution levels, combating the Contribution risk.

4. Continued

Proposed change to investment options: Reduce the number of options, as this has been shown to lower fees, which would reduce the Fee risk.

Proposed change to employee loans: Prohibit employee loans. This would reduce the use of retirement income for current consumption, which would combat the Leakage risk.

Proposed change to the form of distribution: Provide annuities rather than lump sums (or at least offer annuities as an option under the plan). This could help eliminate longevity risk, which is related to the Drawdown of Benefits risk in part (a).

5. Learning Objectives:

10. The candidate will be able to analyze the relationship of plan investments with plan design and valuations.

Learning Outcomes:

(10b) Solve for a measure of investment performance relevant to a given benchmark.

Sources:

RD129-09, How the Liability Benchmark is Developed and Used in Practice

R-D123-07: Maginn and Tuttle, Managing Investment Portfolios, Third Edition, Chapter 12 through Section 7

Commentary on Question:

In this question, candidates were asked to demonstrate their understanding of asset-only and liability benchmarks. A well prepared candidate would be able to define, compare and contrast two benchmarks.

Solution:

(a) In an asset-only framework, macro attribution analysis is used to evaluate an asset manager's investment performance.

Describe the following components of macro attribution analysis:

(i) Risk-free asset.

(ii) Asset categories.

(iii) Net contributions.

Commentary on Question:

Most candidates were able to answer (i) and (ii) well. (iii) seemed to be more challenging. The key to Net Contributions macro attribution analysis is that it assumes the net cash flows are invested at 0%. Some candidates wrote that Net Contributions analysis shows how the fund is affected by the timing of contributions, which is incorrect.

(i) Risk-Free Assets macro attribution analysis assumes the fund's beginning value and its net external cash inflows are invested at the risk-free rates. The investment strategy is highly conservative and risk-averse and invests all assets in risk-free assets, such as 90-day Treasury bills. The fund's value increases by an additional amount over the value achieved under the Net Contributions investment strategy.

5. Continued

(ii) Asset Categories macro attribution analysis assumes the fund's beginning value and external cash flows are invested passively in a combination of the designated asset category benchmarks – a pure index or all-passive approach. The specific allocations to each benchmark are based on the plan sponsor's investment policy allocation.

Fund sponsors typically choose to allocate funds within an asset category among a number of active managers with different investment styles and therefore expose their assets to 2 additional sources of investment returns/risks – investment style and active management skills.

(iii) Net Contributions macro attribution analysis assumes the net flows are invested at a zero rate of return. Fund value changes simply by the net inflows (i.e. ending market value = beginning market value + net inflows). Net Contribution macro attribution analysis provides a useful baseline for performance analysis.

(b) In an asset-liability framework, a liability benchmark can be used to measure plan performance.

(i) Define a liability benchmark.

(ii) Describe how to create a liability benchmark.

Commentary on Question:
Most candidates were able to define a liability benchmark correctly.

For part (ii), most candidates were able to describe the steps of obtaining and discounting benefit cash flows. The alternative solution to this particular question is to create a liability index and replicate the benchmark using swap securities that comprise a specific curve used to discount liability cash flows.

(i) A liability benchmark represents the fair market value of a pension plan's obligations. It is similar to a standard market index that represents a collection of securities that can be used to analyze performance.
Each plan's benchmark is unique due to plan demographics, plan type, participant age, number of participants, etc. There are 6 characteristics of a market-based benchmark useful for comparison in formulation of a liability benchmark:

- Unambiguous
- Investable
- Measurable
- Appropriate

5. Continued

- Reflective of current investment options
- Specified in advance

(ii) Steps of creating a liability benchmark:

1) Obtain projected benefit cash flows – benefit payment profile might be based on ABOs or PBOs
2) Consider plan-specific factors such as economic and demographic assumptions, plan design and country-specific accounting rules and regulations
3) Discount cash flows to calculate present value using market based rates (e.g. full yield curve approach based on corporate or government yield curves).

(c) Compare and contrast a liability benchmark with an asset-only benchmark.

Commentary on Question:
The key concept here is that an asset-only benchmark only focuses on asset performance, while a liability benchmark focuses on plan liability and funded status. Most candidates were able to describe an asset-only benchmark correctly, but were not able to explain in detail how a liability benchmark is different from asset-only benchmark.

An asset-only benchmark is a blend of market indices, typically a policy benchmark (e.g. x% in equity, y% fixed income). It is intended to mirror the asset allocation established by the plan sponsor or trustee to compare asset-only results with the blended index performance. It only focuses on asset performance compared to the policy benchmark, not the plan's funded status.

A liability benchmark focuses on plan liability, and the asset performance is measured relative to movements in liabilities. It aligns the plan assets to make certain of benefit payments for the liabilities they are expected to support. It provides pension stakeholders with an accurate measure of the plan's funded status and ensures its survival/ongoing viability.

6. Learning Objectives:

3. The candidate will be able to analyze plans designed for executives or the highly paid.

Learning Outcomes:

(3a) Given a specific context, apply principles and features of executive deferred compensation retirement plans.

Sources:

R-D804-09: Internal Revenue Code 409A and Non-Qualified Plan Design Consideration

Allen, et al, *Retirement Plan: 401 (k)s, IRAs, and Other Deferred Compensation Aproaches,*10th Edition, 2008, Ch. 10 pp.175-178

R-D147-12: Executive Retirement Benefits Practice: 2011 Report, Towers Watson

Commentary on Question:

This question was trying to test the candidate's knowledge of deferred compensation plans for executives, including the implications of Section 409A on these plans. The candidate was asked to design a plan that meets the CEO's objectives and is compliant with Section 409A.

Solution:

(a) Describe the key plan provisions that should be included in a deferred compensation plan.

Commentary on Question:

In this part, the candidate was asked to outline the key plan provisions of a deferred compensation plan, as well as to provide specifics. More points were given for descriptions of the provisions versus providing a list.

The Watson Wyatt study note has a plan drafting checklist that provided a good framework for this portion of the question.

Eligibility – who is eligible to participate?
Deferral – what is the deferred amount the employee will receive?
Elections – initial and subsequent – what are the conditions under which new participants will make deferral elections? Subsequent deferral elections?
Vesting – when will benefits become nonforfeitable
Distribution events – when will amounts be paid?
Allowable acceleration of payments – under what conditions can payments be accelerated?
Allowable delay of payments – under what conditions can payments be accelerated?
Installment payments – how will they be treated?
Funding – will the plan be funded, and if so, how?

6. Continued

(b) Describe the implications Section 409A has on deferred compensation plans.

Commentary on Question:
In this part the candidate was asked to describe how 409A affects deferred compensation plans. The Watson Wyatt note contained a 409A "checklist" that provided a good framework for this portion of the question.

Eligibility – no rules in 409A
Deferral – no rules in 409A except for plans linked to qualified plans
Elections – initial and subsequent – 409A has requirements that initial deferral elections be made under one of two rules – new participant rule, excess plan rule. Changes to time or form of payment are permitted under 409A, as long as certain conditions are met: election must be made at least 12 months before the scheduled payment, the election must be effective for at least 12 months after it is made, and the payment must be delayed for at least 5 years from the date of the original payment.
Vesting – no rules in 409A, vesting can be accelerated as long as benefit payments are not accelerated
Distribution events – employer decides on these, 409A limits to: separation from service, death, disability, specified time or schedule, change of control, unforeseeable emergency, plan termination
Allowable acceleration of payments – 409A permits some exceptions to accelerated payments
Allowable delay of payments – 409A permits some exceptions to delayed payments
Funding – possible future guidance under 409A

(c) Using the plan provisions identified in (a), recommend a deferred compensation plan design that:

- Meets the CEO's objectives; and
- Is Section 409A compliant.

Justify your answer.

Commentary on Question:
In this part, the candidate was asked to use the provisions defined in (a) as a framework for a recommended plan design. The candidate was also asked to justify the answer.

Many candidates were able to put a design together, but neglected to support the design with the CEO's objectives.

6. Continued

Eligibility – CEO, CFO, COO. Meets objective of attracting / retaining executives. Compliant with 409A, which has no rules on this.
Deferral – participants may defer 10% to 50% of their base salary and bonuses. Meets objective of financial planning flexibility for the executives. Compliant with 409A, which has no rules on this, since this plan is not linked to a qualified plan.
Elections – initial elections will be made under the new participant rule, as provided in 409A. Meets objective of administrative simplicity.
Vesting – participants will vest after 2 years, meets objective of attracting / retaining executives.
Distribution events – amounts can be paid at separation from service, death, disability, and change of control, all as permitted under 409A. Meets objective of financial planning flexibility.
Funding – plan will be funded through general assets. Complies with 409A, which does not have rules on this as of now. Meets objective of administrative simplicity.

7. Learning Objectives:

10. The candidate will be able to analyze the relationship of plan investments with plan design and valuations.

Learning Outcomes:

(10a) Evaluate the interaction of plan investments and:

- Plan design,
- Plan funding,
- Valuation assumptions, and
- Valuation methods.

Sources:

R-D131-09: Plan Sponsor Guide to Liability-Driven Investing

R-D132-09: Top 10 Myths About Liability Driven Investment

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge of LDI strategies and describe how this can be used to minimize interest rate risk. A well prepared candidate was expected to understand how LDI minimizes interest rate risk by extending the duration of the plan, and the limitations of LDI Strategies.

Solution:

(a) Critique the following assertions regarding LDI strategies:

(i) The interest rate risk in most pension liabilities is an uncompensated risk, so it is always a good idea to reduce it as much as possible.

(ii) An LDI strategy can completely eliminate interest rate risk.

(iii) Interest rate risk can be hedged by analyzing the timing of future benefit payment cash flows and matching the fixed income exposure to that timing.

Commentary on Question:

Part (a) was based on Myths 2, 3 and 8 from study note R-D132-09: Top 10 Myths About Liability Driven Investment.

(i) This assertion assumes that if a plan sponsor cannot predict future interest rates, this risk is unintentional and uncompensated.

LDI assumes that pension liabilities have interest rate sensitivity similar to long-term corporate bonds. If plan assets do not have this same sensitivity, then the funded status changes with interest rates. This interest rate mismatch can be removed by using longer duration bonds and/or interest rate derivatives.

7. Continued

Implementing a full interest rate hedge may not be optimal: If interest rates are expected to increase, some interest rate exposure may be preferred. For some plan sponsors, the interest rate risk in the pension liabilities may be a natural hedge for other interest rate risks in their income statement and balance sheets. Full interest rate hedging may require derivatives that some plan sponsors cannot use effectively. Finally, there is a point of diminishing impact, beyond which the extra precision does not justify the added costs.

(ii) Although an LDI strategy can reduce most interest rate risk, it is difficult to match the discount rates used in GAAP accounting, or the discount rates under the Pension Protection Act (PPA). Many LDI programs that emphasize interest rate risk reduction use LIBOR swaps, but these have lower yields than the high-quality corporate bond rates used to measure liabilities. Treasury Strips are even lower yielding.

Even the most carefully crafted LDI strategies cannot eliminate all interest rate risk due to defaults and ratings migrations. While a great deal can be done to hedge interest rate risk, plan sponsors need to be realistic about what is possible. The task is to optimize the interest rate hedge within "real world" practical constraints.

(iii) This assertion is common among asset managers unfamiliar with pension liabilities. Many plans have interest sensitive cash flows, while others have durations longer than the apparent durations of their cash flows. Cash balance plans and traditional plans paying lump sums are common examples. While most pension actuaries are trained to adjust for interest sensitive cash flows and forms of payment, a LDI program designed by someone unfamiliar with these issues can result in the plan sponsor taking on unintended risks.

(b) Given the CFO's concern, describe an appropriate LDI strategy for the Salaried Pension Plan for each of the following funding strategies:

(i) Immediate full funding.

(ii) Fully funding the plan over a five year period.

Commentary on Question:
Part (b) was based on LDI strategies to minimize interest rate risk described in study note R-D131-09: Plan Sponsor Guide to Liability-Driven Investing. Responses should have been based on this study note and made reference to the Salaried Pension Plan from the case study.

7. Continued

(i) If NOC makes large contributions to fully fund the plan, then it should apply LDI to minimize interest rate risk and protect the downside risk of funded status ratio.

Current plan assets have 55% equities. The duration of assets is smaller than the duration of liabilities. The Salaried plan is 85% funded at 1/1/12, so the plan sponsor contribution will need to be large to fill funded status gap.

Sensitivity to changes in interest rates is the main cause of variability in pension liabilities. To hedge this interest-rate sensitivity, we change the duration of assets to be similar to the duration of liabilities. We can increase the duration of assets, substituting long bonds for intermediate bonds or increasing the proportion of long bonds. We recommend changing asset allocation towards a higher concentration of fixed income to match liability duration.

This strategy does not use derivatives, avoiding their disadvantages: sufficient liquidity to fund margin requirements, other risks including counterparty, liquidity, valuation and tracking. This strategy does not use equities, forgoing the upside potential (not needed for fully funded plan), but protects from funded status deterioration.

(ii) The answer will be different if NOC wants to fully fund the plan within five years. Before the plan is 100% funded, need equities for upside potential.

To match duration, we can combine bonds and derivatives to control interest rate risk, using fixed income derivatives (futures and forward contracts, swaps and options) to increase duration. The more aggressive the portfolio, the more derivatives are used to bridge the duration gap. The advantage of using derivatives is that they overlay assets; they do not have to sell equity or bonds to achieve the desired duration.

Once Plan is fully funded, change assets to 100% fixed income to match liability duration.

8. **Learning Objectives:**

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

2. The candidate will be able to understand how the regulatory environment affects plan design and understand how to apply relevant restrictions.

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

Learning Outcomes:

(1a) Describe the structure of the following plans:

- Fixed dollar and pay-related defined benefit plans
- Hybrid plan designs such as, cash balance, pension equity, and floor offset plans, target benefit plans
- Defined contribution plans including 401(k) plans and capital accumulation plans
- Retiree Health Plans

(1d) Given a plan type, explain the relevance and range of plan features including the following:

(i) Plan eligibility requirements
(ii) Benefit eligibility requirements, accrual, vest and phased retirement
(iii) Benefit/contribution formula
(iv) Payment options and associated adjustments to the amount of benefit
(v) Ancillary benefits
(vi) Benefit subsidies and their value, vested or non-vested
(vii) Participant investment options
(viii) Required and optional employee contributions
(ix) Phased retirement and DROP plans

(2a) Explain and apply the regulatory limits placed on types of plans that can be offered.

(2b) Explain and apply restrictions on plan design features to a proposed plan design.

(6c) Evaluate appropriateness of current assumptions given the purpose.

Sources:

R-D143-11: The Funding of State and Local Pensions: 2009-2013

R-D807-11: State and Local Government Pension Plans, Current Structure and Funded Status

R-D137-10: Discounting State and Local Pension Liabilities

8. Continued

R-D810-12: The Economics of State and Local Pensions

Commentary on Question:
Commentary listed underneath question component.

Solution:

(a) Explain the key causes of the current funding problems facing public pension plans.

Commentary on Question:
This question required candidates to explain how the various factors of public plans can impact the funded status. Well prepared candidates were able to discuss funding issues specifically impacting public pension plans.

Candidates were generally able to explain how the current funding requirements and generosity of benefits negatively impact the plan's funded status. While candidates understood that higher discount rates reduce the pension obligations, very few mentioned that higher discount rates also reduce the required contributions. Most candidates understood that public plans generally increased benefit benefits during strong economic times, but failed to mention that during down market benefits were not adjusted downward.

Where candidates did poorly in this question was that candidates failed to explain how the investment structure and public policy could impact the plan's funded status.

Funding Requirements
- Contributions do not maintain or improve funded status
- History of failing to contribute sufficient annual contributions
- Higher discount rates reduces the value of pension obligations
- Higher discount rates reduces the required contributions

Investment Structure
- Large exposure to equity risk

Benefit Structure
- Benefit increases during good times and no adjustment during bad times
- Prevalence of COLAs

Public Policy
- Even if legally permissible to reduce benefits, politicians face pressure from public sector employees and unions

(b) Assess the merits of pre-funded and pay-as-you-go funding policies for public pension plans.

8. Continued

Commentary on Question:
In this section candidates were required to discuss the methods of funding public defined benefit plan. Candidates generally did poorly in this section because they failed to discuss the merits in the context of public pension plans.

Reasons for Pre-Funding

- Cost of the benefit earned in that years should be funded at the time service is performed
- Not pre-funding could result in dire consequences if taxpayers unwilling to meet obligation
- Ensures true cost of benefit is recognized

Reasons for Pay-As-You-Go

- Transfers cost to future generations
- Government has the ability to tax allows plans to operate forever

(c) Describe the constraints that limit significant change from taking place in public pension plans.

Commentary on Question:
Most candidates were able describe how government plans were restricted in their ability to increase contributions and reduce benefits. Where candidates did poorly in this section was that they failed to describe all of the reasons that the process to increase contributions is so lengthy.

- Statutory contribution requirements and must obtain approval for any change to increase contributions
- Political process may take time to recognize and act on the need for increased contributions
    - Competing interests
    - Popular vote and re-election concerns
    - Political pressure
    - Union pressure
- Constitutionally constrained in their ability to reduce benefit

9. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions

Learning Outcomes:

(6c) Evaluate appropriateness of current assumptions given the purpose.

Sources:

Selecting and Documenting Mortality Assumptions for Pensions (Academy paper)

R-D125-11: ASOP No. 35 Selection of Demographic and other Noneconomic Assumptions for Measuring pension Obligations

R-D112-10: 2009 Selection of Actuarial Assumptions, Consultant Resource Manual, SOA Version, Mercer

Commentary on Question:

In this question, candidates were asked to demonstrate the following:

- ability to analyze a mortality table assumption for a defined benefit pension plan and provide comments on its reasonableness
- describe the process for selecting an appropriate mortality table and mortality improvement assumptions
- list factors that are considered when selecting a mortality table and mortality improvement assumptions; and
- provide considerations in selecting mortality improvement assumptions.

For part (a), a well-prepared candidate would have commented on each aspect of the current assumption with respect to all the details provided regarding the assumption. The candidate should have explained why the assumption was or was not appropriate.

For part (b), the candidate should have described in general how an assumption is selected and then provide details regarding specific considerations for selecting mortality and mortality improvement assumptions.

Solution:

(a) You are given the following for a defined benefit pension plan:

- Plan membership consists of 12,000 actives and 60,000 inactives (terminated vested participants, disabled participants, retired participants, and beneficiaries);
- There is no assumption for pre-retirement mortality; and
- The post-retirement mortality assumption is a static 2005 unisex group life insurance mortality table.

Critique the current mortality assumptions.

9. Continued

Commentary on Question:
Overall candidates responded sufficiently for part (a).

Pre-Retirement Mortality
Pre-retirement mortality generally does not have a significant impact on results, so assuming no pre-retirement mortality could be considered appropriate. However, it is usually only excluded for small plans and this plan has a large active population.

Post-Retirement Mortality
The assumption does not include mortality improvements which should be considered.

A separate assumption for disabled participants may be appropriate depending on actual plan experience and the plan definition of disability.

Gender is typically reflected in mortality assumptions as male and female mortality can be significantly different. The unisex weighting of the current table may not appropriately represent the plan's population.

The mortality table for pension valuations should be a group annuity table and not a group life insurance table. The group life insurance table is not considered reasonable for pension purposes as group life insurance tables have higher rates of mortality and are generally loaded for adverse experience.

(b) Describe the process and considerations for selecting appropriate mortality assumptions.

Commentary on Question:
For part (b), many candidates did not include a discussion of the assumption setting process or mention mortality improvements prior to the measurement date.

The process for setting a mortality assumption is as follows:

- Identify the type of assumption that is appropriate considering the purpose of the measurement, characteristics of the group, and materiality
- Consider the relevant assumption universe – standard tables and modifications
- Consider plan demographic factors – collar, income, gender, occupation, status, type of retirement form of payment, presence of medical coverage, and any other relevant factors
- Select the assumption
- Evaluate the assumption for reasonableness; the expectation should be that the assumption does not produce significant gains or losses

9. Continued

The assumption selection should consider that mortality rates will have improved since the base year of the table. The selected table should reflect mortality improvements to both the measurement date and anticipated future improvements in mortality.