DP-RC Complete Illustrative Solutions
Fall 2010

1. 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.

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

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

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding, accounting and measuring economic value.

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

(6e) Evaluate the appropriateness of actuarial assumptions using both a traditional and a financial economics perspective.

Sources:

Yamamoto pp. 57-68 and pp. 287-294

SN "Measuring Terminable Post-retirement Obligations"

Grader Commentary:

In this question, candidates were asked to demonstrate their understanding of the reasons employers are eliminating retiree benefits and to discuss possible refinements to the current actuarial model to take into account this ability of employers to unilaterally change future cash flows.

1. Continued

A well-prepared candidate would have been able to identify and briefly explain three to four of the six main reasons employers cite to reduce or eliminate future retiree benefits. A well prepared candidate would also been able to describe the three refinements to the current actuarial model.

Solution:

(a)

Employers do not receive full credit for tax effective retiree benefit plan

- Hidden costs of their subsidy to plan
- Discount value due to employer ability to change plan design

Benefits are valuable to minority of active employees

- Long duration till benefit eligibility/Not seen as valuable benefit until employee nears retirement

Sense of social responsibility of employer to provide benefits diminishing/Move away from paternalistic philosophy; Retiree should share cost

Long term career employment diminishing/Workers Independence/Lack of Loyalty

- Benefit not portable

Reduction in cost to stay competitive

- Global competitors and newer industries tend not to provide these benefits
- As more of the competition eliminates retiree benefits, makes it easier to drop or reduce coverage

(Cash) Cost increasing faster than any other item for most companies

- Accrual cost required by FASB is a significant measure/Accounting cost/liabilities too volatile/large
- No longer a nominal financial commitment
- Health care inflation outpaces general inflation
- Life expectancy continues to increase
- Number of retirees is growing (baby boomer)

Recent negotiating ability with respect to unionized retiree benefits

- Value of deferred benefits traded for something more valuable to current workers
- Legacy costs difficult to maintain and partially responsible for companies' financial difficulty

1. Continued

(b) **1. Risk adjusted discount rate**

- Rate will be higher than risk-free rate
- Reflects rate associated with plan change
- Aggregate present value using this rate should be same as derived under other two refined methods
- Discount rate should be selected by plan sponsor and not mandated by market
- Should select discount rate without regard to funded status
- Acknowledges uncertainty more than the other two refinements
- Easily fits into financial economics
- Fits easily into realm of financial reporting (i.e. FAS 106, only need to change reference to high-quality long-term bonds as determinant of discount rate)
- Preferred approach

2. Plan termination decrement

- Explicitly assumes a bimodal distribution of either continuing unchanged or termination
- Plan termination decrement of t (i.e. 5%) per year
- Plan survival probability of that period is $1 - t$ and would have cumulative effect over the years

3. Specific estimates of future reductions

- Quantifies probability, amount and timing of reductions and reflects in aggregate present value
- Plan sponsor would specify timing and proportion of future reductions
- Most labor intensive
- Used to establish most likely path for plan payments (benefit levels) in light of major uncertainties involved
- Assumes plan sponsor knowledge of projection results of traditional actuarial model for particular plan on period-by-period basis

2. 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 the purposes of the valuation.

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.

Sources:

CIA Education Note: Guidance on Asset Valuation Methods, November 2007 B

Pension Forum 9/2002 on asset method Ch. 1,3,4,5

CSOP

Grader Commentary:

The candidate will be able to:

(a) Name and, where appropriate, provide some additional details about the desirable characteristics of an asset valuation method. We were also looking for some comments about the acceptable bias in any asset valuation method;
(b) Calculate the assets using a smoothed valuation method;
(c) Compare and contrast using the market value approach versus the smoothed valuation method approach in selecting an asset valuation method; and
(d) Understand the professional standards and professional code of conduct which an actuary must consider when developing and comparing asset valuation methods.

A well prepared candidate would have been able to: within part (a), name four of the seven desirable characteristics in an asset valuation method, within part (b): determine cashflows and setup formulas to prove understanding of the requisite calculations, and within part (c), name three to four of the professional standard requirements/issues.

Solution:

(a) List the desirable characteristics of an asset valuation method.

1. Achieves Plan Objectives

Example, if the primary objective is to moderate volatility of contribution rates through deferral of investment gains/losses, the asset valuation method would facilitate this result.

2. Tracks to Market Value

Method should include current market value as a component; asset value is expected to track to market value over time.

2. Continued

3. Does Not Unduly Deviate From Market Value

4. Has a reasonable and logical relationship to market value.

5. Is Generally Free of Any Bias

6. Has No Undue Influence on Investment Transaction Decisions or Vice Versa

7. Is Consistent With the Length of Typical Economic Cycles
Methods that delay recognition of investment related gains or losses over periods that extend beyond typical length of economic cycle may go beyond moderating volatility and create intergeneration transfers of wealth; method delays over a period of 5 years or more typically would not be appropriate.

Acceptable bias (method can have one or both of the following:
(a) Produces asset values that are consistently less (greater) than corresponding market values during sustained periods of investment gains (losses).
(b) Produces asset values that approach market values asymptotically, assuming constant asset returns in the future.

Best practice: Adherence to all the desirable characteristics is best practice but not required to comply with accepted actuarial practice. Actuary should exercise judgment in determining minimum level of adherence to achieve accepted actuarial practice. If there are any deviations, actuary should be prepared to justify deviations.

(b)

Solution One (Simple Interest) (Note: compound interest approach can also be used)

2008 Cashflow (CF) = 2008 ER Contributions - 2008 Benefit Payments
= 12,000 - 26,000 = (14,000)

2009 Cashflow (CF) = 2009 ER Contributions - 2009 Benefit Payments
= 11,990 - 28,000 = (16,010)

2008 Adjusted Market Value (AMV) at 1.1.2009 = 2008 Market Value (MV) + 2008 CF + (2008 MV + 2008 CF/2) * .065
= 922,971 + (14,000) + 59,538 = 968,509

2008 AMV at 1.1.2010 = 2008 AMV at 1.1.2009 + 2009 CF + (2008 AMV at 1.1.2009 + 2009 CF/2) * .065
= 968,509 + (16,010) + 62,433 = 1,014,932

2009 AMV at 1.1.2010 = 2009 MV + 2009 CF + (2009 MV + 2009 CF/2) * .065
= 744,096 + (16,010) + 47,846 = 775,933

2. Continued

2010 AMV at 1.1.2010 = 2010 MV
= 683,921
Smoothed Actuarial Value of Assets = (2008 AMV at 1.1.2010 + 2009 AMV at 1.1.2010 + 2010 AMV at 1.1.2010)/3
= (1,014,932+ 775,932 + 683,921)/3 = 824,928

Solution Two (Simple Interest) (Note: compound interest approach can also be used)

2009 Expected Return On Assets (EROA) = (1.1.2009 MV + 2009 ER Contributions *.5 - 2009 Benefit Payments *.5) * .065
= (744,096 + 11,990 *.5 - 28,000 *.5) * .065 = 47,846
2008 Expected Return On Assets (EROA) = (1.1.2008 MV + 2008 ER Contributions *.5 - 2008 Benefit Payments *.5) * .065
= (922,971 + 12,000 *.5 - 26,000 *.5) * .065 = 59,538
2009 Actual Return = (44,165)
2008 Actual Return = (164,875)
2009 Gain (loss) = 2009 Actual Return - 2009 EROA
= (44,165) - 47,846 = (92,011)
2008 Gain (loss) = 2008 Actual Return - 2008 EROA
= (164,875) - 59,538 = (224,413)
2009 Unrecognized Gain (loss) = 2009 Gain (loss) * 2/3
= (92,011) * 2/3 = (61,341)
2008 Unrecognized Gain (loss) = 2008 Gain (loss) * 1/3
= (224,413) * 1/3 = (74,804)
Total Unrecognized Gain (loss) = 2009 Unrecognized Gain (loss) + 2008 Unrecognized Gain (loss)
= (61,341) + (74,804) = (136,145)
Smoothed Actuarial Value of Assets at 1.1.2010 = MV at 1.1.2010 - Total Unrecognized Gain (loss)
= 683,921 - (136,145) = 820,066

2. Continued

(c) An actuary should select an asset valuation method which is appropriate for the purpose and circumstances of the work.

Professional Integrity: Act with skill and care; don't be associated with anything false or misleading

Standards of Practice: Meet applicable standards of practice

Control of Work Products: Take reasonable steps to ensure that services are not used to mislead

- Need to consider if using the AVA can result in misleading employees and the employer in believing plan is better funded (note, the funded ratio on GC basis changes from 80% to 96% if smoothing is used)

Use of Corridor: Ratio of the AVA ($824,936) to MVA ($683,921) = 1.21

- Need to assess if appropriate to use AVA; may want to consider a corridor so that AVA tracks to MVA and is capped
- Corridor should be balanced
- Example, may want to set at 120% of market value when AVA is high and set at 80% of market value when AVA is low
- Changing asset valuation method to smoothed method: Need to justify why the change in the asset valuation method is warranted

Reasons to Use Alternate Methods in Particular Smoothing: Objective of an asset valuation method that produces an asset value other than market value is generally not to moderate volatility in the reported financial position of a pension plan; rather it is usually a means to implement another objective

- Examples: For going concern and solvency, to moderate the volatility of contributions; and for accounting, to moderate the volatility of net benefit cost recognized in financial statements

Solvency Valuation: Measurement of assets are prescribed by legislation; some jurisdictions allow for smooth method

- Hypothetical windups must use market value of assets
- Changing asset valuation methods repeatedly not desirable
- Changes to the asset valuation method, especially repeated changes over a relatively short period of time, may be contrary to one of the desirable characteristics of an asset valuation method, namely that the method not be biased

2. Continued

Disclosure:
Paragraph 3600.01 of the Standards of Practice Contains Reference to Disclosure of the Asset Valuation Method: In the case of an external user report on work which includes the valuation of assets and liabilities, the actuary should summarize the result of the valuation and should describe…the method to value the assets, their value, and if available, their market value and their value in the plan's financial statements, and an explanation of any differences among them.

Best practices would include the following additional disclosures:

- The detailed calculation of the value of assets
- The objective(s) of any asset valuation method which deviates from market value
- The rationale supporting the asset valuation method
- The application of any corridor
- The type and degree of any bias that may exist in the asset valuation method
- The rationale for any changes in the asset valuation method

Conservatism: There are certain circumstances where an asset valuation method may intentionally contain a measure of conservatism and where such conservatism may be appropriate

- In such circumstances, a best practice would be to disclose the inconsistency with the "generally free of any bias" characteristic and to also provide the rationale for such inconsistency

3. 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:

(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

Sources:

Allen Chapter 3

Allen Chapter 5; pp 80-85

Grader Commentary:

The candidate is being asked to demonstrate an understanding of the key characteristics and differences of defined contribution and defined benefit plans, and how each design type may support the company's key objectives. One specific area of focus is the impact of retirement income of participants under a defined contribution structure. We are looking for candidates who can apply the concept of DB vs. DC to the question rather than just providing a list.

A well prepared candidate would have been able to discuss three to four of the key objectives and how DB and DC plans meet each objective.

Solution:

(a) **1. Single Plan Should Cover All Salaried Employees**

DC Plans

Covers all employees

DB Plans

Can be designed to cover all employees

FAP plans can have minimum hour requirement preventing benefit accruals for part-time employees

NOC Key Objectives

Key Issue #1: Both DC and DB plans can be designed to cover all salaried employees

3. Continued

2. Plan Should Minimize Cost Volatility

DC Plans

Employees bear investment risk
Typically contributions allocated to employees based solely on pay
ER contributions can be defined (i.e. flat % of Pay or can be at ER's discretion but must define how contributions are allocated to members)

DB Plans

Investment risk borne solely by employer

NOC Key Objectives

Key Issue #2: Minimizes cost volatility if ER contribution is defined since contribution amount known
Key Issue #2: Movement to DC plan (whether by close or freeze) should address cost volatility as NOC will have less responsibility for shortfalls in assets relative to liabilities

3. Plan Should Be Attractive to New Employees

DC Plans

More level accruals over career
More favorable to mobile, short service employees as greater benefits provided to employees who terminate early in career
Employers may opt for age/service/points-based design to allow for greater accruals later in employee's career to mimic DB plan accruals
Benefits at retirement can be taken as lump sum

DB Plans

Accruals early in employee's career are small with significant accruals in later years
Greater accruals in later years due largely to final average pay designs and subsidized early retirement
Benefits at retirement must be taken as a pension

NOC Key Objectives

Key Issue #3: May be attractive to some members
Key Issue #3: DC plans are typically more attractive to new employees than DB plans due to large allocation of employer contributions (e.g. higher accruals in early years)
Key Issue #3: Accrual patterns in DC plan are more attractive to potential new employees (especially younger hires) and younger current employees

3. Continued

4. Plan Should Encourage Retention of Current Employees

DC Plans

May have allocation based on age/service in graded designs
Integration with Social Security possible, but less common and less efficiently than DB plans

DB Plans

Contributions allocated based on employee's age, past service and pay under plan formula
Relatively common to integrate with Social Security using estimated Social Security benefits or covered compensation

NOC Key Objectives

Key Issue #4: Depending on DC plan design, retention of current employees could be a problem if the larger DB accruals or subsidies no longer exist in a new design
Key Issue #4: Move to DC Plan without inflation protection may hurt employee retention of older employees
Key Issue #4: Since allocations in DC plans are based less on age and service, employee retention is at greater risk in a DC plan
Key Issue #4: Contributions structured around age/svc; can provide higher contributions as approaching retirement and thus may encourage retention
Key Issue #4: Integration could enhance retention of higher paid employees since diminishing Social Security income will be accounted for in the NOC plan

5. Employees Should Share Responsibility for Retirement Income

DC Plans

Pre-tax and after-tax contributions permitted (i.e. voluntary costs)

DB Plans

Only after-tax contributions permitted
May provide matching contributions

NOC Key Objectives

Key Issue #5: Allowing/requiring employee contributions shifts more responsibility of retirement income to employee
Key Issue #5: Greater employee responsibility for retirement income may require employees to earn greater investment returns to make up for lack of inflation protection; result may be more aggressive investments and potential for volatile retirement income levels
Key Issue #5: Move to DC plan will shift more responsibility of retirement benefits to employee

3. Continued

Key Issue #5: A significant portion of employee responsibility for retirement income is managing investment risk in DC plans
Key Issue #5: NOC may consider expanded education initiatives to assist employees in event of design change to DC
Key Issue #5: Matching contributions encourage employee savings and sharing of responsibility

6. Plan Should Protect Retirement Income for Existing NOC Employees

DC Plans

Investments which are too conservative over career may result in less than adequate retirement income
Investments which are to aggressive over career may result in volatility and uncertainty in retirement income approaching retirement
Provide benefits which may fail to meet or which may exceed intended targets
Benefits dependent on employee savings patterns, investment returns, inflation
No pre-retirement inflation protection since benefit accruals are more career-average in nature
No post-retirement inflation unless indexed annuity option is available at retirement (rare)

DB Plans

Can be designed to meet employer's specific income replacement objectives
Pre-retirement inflation exists in final average pay plans since benefits may be based in pay in 3 – 5 years immediately prior to retirement

NOC Key Objectives

Key Issue #6: One method to protect accrual patterns and subsidies is to grandfather all or some of the current DB plan participants
Key Issue #6: Without grandfathering of DB plan, an age/service tiered DC design could protect a portion of the escalated accruals later in an employee's career

(b) **Contributory Nature of DC Plans**

Retirement income will be heavily dependent on employee's ability and willingness to save for own retirement
More critical in plans where sole benefit is an employer match

3. Continued

Length of Service
Employees who join a DC plan later in career are likely to have less retirement income from the plan due to:

- Shorter period of employee and employer contributions
- Less interest compounding of investment returns

Benefit Accruals
DC accruals are career-average in nature
Retirement income may not be adequate due to lack of pre-retirement inflation protection that may exist in final-average DB plan

Form of Payment
DC Plans typically pay benefits in lump sum form

- Requires participant to manage investment of funds as well as withdrawals whereas each are managed automatically if benefits paid from DB annuity

Participants are more likely to either outlive lump sum benefits or spend lump sums on expenses not related to retirement

Uncertainty of Benefits
Employee's benefit can only be estimated even approaching retirement since benefits are heavily dependent on investment returns and contribution levels – difficult for retirement planning

4. 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.

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

Learning Outcomes:

(1b) Describe the process and apply the principles of conversions from one plan type to another.

(3b) Given a specific context, apply principles and features of supplemental retirement plans.

(3c) Integrate a plan for executives with the basic benefit plan.

Sources:

Allen Chapter 3

Allen Chapter 14

Allen Chapter 17 - US Only

Morneau Sobeco- Chapter 1

Morneau Sobeco- Chapter 11

Study note: R-D101-07

Grader Commentary:

Candidate should address the key aspects of the proposed plan designs for the combined company. This discussion should highlight how the various employee groups at the two companies will fair under the design alternatives. Based on those advantages/disadvantages, along with corporate objectives, candidates should provide a recommendation of the best alternative for the combined company. This should be specific to the key objectives and kept at a high level.

A well prepared candidate would have provided both advantages and disadvantages under each proposal. Many candidates only provided answers under one proposal or only provided either advantages or disadvantages under both proposals. We were looking for a balanced answer.

4. Continued

Solution:

(a) **Proposal 1 – Advantages**

NOC Salaried employees and SERP participants

No loss or change in retirement benefits (i.e. protecting legacy of NOC employees)

ABC employees near retirement

- Entire retirement benefit will not be susceptible to investment risk
- Greater early retirement subsidies provide more valuable benefit
- Greater portion of benefit protected from pre-retirement inflation through use of final average pay formula

All other ABC employees

- More valuable benefit if remain working for NOC for years after acquisition
- Greater portion of retirement benefits subject to less investment risk and/or pre-retirement inflation risk

ABC SERP participants

- Greater benefit in NOC SERP (2% FAP5 vs. 1.5% FAP3)

NOC

- No communications/employee relations issues through benefit changes
- Given demographics of ABC group, newly acquired employees would likely be less expensive under a DB plan in the first few years after the transaction
- All employees would be covered under a single benefit plan; avoids maintenance of two separate plans
- Ability to retain current employees remains intact through early retirement subsidies in DB plan
- Ability to provide early retirement subsidies provides vehicle to impact employee behavior (i.e. early retirement windows)

Proposal 1 – Disadvantages

NOC Salaried employees and SERP participants

- SERP is not funded – addition of more members to SERP may increase probability of future on-payment
- DB plan is now more costly due to increased membership, may affect Company's ability to provide benefits

4. Continued

ABC employees near retirement

- Disruption of benefit structure will require additional communication and education
- NOC DB plan is more complex and difficult to communicate (monthly benefit vs. account balance)
- Question of past service with ABC counting toward vesting, early retirement in NOC plan – if not, must stay with NOC to earn benefits and early retirement subsidies
- Question of pay definition in current ABC plan – if total comp, then loss of benefits since NOC plan uses base pay only

All other ABC employees

- DB benefit is less valuable for employees who leave NOC prior to early retirement; accruals are likely less than 4% of pay in early portion of career

ABC SERP participants

- None apparent unless pay definition is different

NOC

- Action contradicts concerns over cost volatility as more participants are brought into an unfunded DB plan
- To attain full funding, greater returns will be necessary (absent significant discretionary contributions) which may lead to increased asset volatility and, thus, increased cost volatility
- Maintaining an open DB plan will likely not attract new, younger employees
- Retention of ABC employees may be difficult with DB plan where vesting and early retirement eligibility may/may not include past service with ABC; employees may not value the DB benefit as much as the flexibility of the DC benefit
- NOC responsible for greater share of employees' retirement income (EE's are not sharing in retirement income responsibility)
- Increased level of administration and recordkeeping – i.e. more costly to administer
- Not targeting overall retirement program objectives, including: volatility, attracting new employees, retaining new ABC employees and employees sharing in responsibility for retirement income
- Accounting implications – increases cost and volatility

4. Continued

Proposal 2 – Advantages

Young, short service NOC Salaried employees

- DC benefit carries greater value in early part of career than DB plan
- Less constraint to remain with NOC; more benefit goes with employee in job change
- Greater understanding and appreciation of retirement benefit
- Employees feel empowered through control of retirement investments; opportunity to grow retirement income through investment earnings
- If new plan is profit sharing, employees can feel greater link to company success

Other NOC employees and SERP participants

- If DC plan is age and/or service-based, employees with seniority will earn greater benefits that may allow for closer matching of NOC DB plan

- Grandfathering a segment of population will allow employees to retain current benefit structure
- A DC SERP fits the retirement program objectives better than the current design

ABC employees

- Smooth transition of benefits from current ABC plan
- Age/service based plan will reward older, longer service employees more than current flat DC contribution plan
- Younger employee population has greater appreciation for DC plan
- Greater benefits earned more quickly which may help if workforce reductions are imminent as part of transaction

NOC

- Greater cost stability going forward (addresses issue 2)
- Impact on accounting – greater cost stability and predictability
- Greater appreciation of retirement benefits for younger NOC population after ABC acquisition
- DC benefits are more attractive to new hires; current workforce trends indicate new hires are more mobile (addresses issue 3)
- In later years, cost volatility of NOC DB plan should diminish greatly since no additional benefits being earned
- Shifts responsibility of retirement benefit to employee; shift even greater if new DC plan is match-based (addresses issue 5)
- Employees not only manage investments, but must save own money to earn any benefits for NOC
- Members have better appreciation of DC plan and perceived value

4. Continued

- Flexibility of DC benefit structure allows NOC to reward employees based on corporate objectives
- Reward long service employees: Vary DC plan accruals by age and/or service
- Incentive for company success; utilize profit sharing formula
- Promote join responsibility for retirement saving: Use match-based plan as primary retirement vehicle

Proposal 2 – Disadvantages

Loss

- Older, longer service employees hurt most by change to DC plan
- Loss of benefit accruals under FAP plan which increase later in an employee's career; DC plans typically cannot replicate accrual pattern and early retirement subsidies of DB plan
- Employee bears risk for significant portion (if not all) of retirement benefit from NOC

- Without adequate education, employees will likely fall short of retirement income needs
- Loss of pre-retirement inflation protection with shift to DC plan (career average vs. FAP5 NOC plan)
- SERP participants hurt also since value of DC SERP will likely not reach value of NOC DB SERP

ABC employees

- Longer service employees may have wanted to enter DB plan
- New plan may be less valuable than ABC plan or may be age/service based which provides lower benefits to younger, shorter service employees
- SERP participants hurt with shift from DB design to DC

NOC

- Costs shifted from older longer service (early retirement subsidies) to younger employees (DC allocation with shorter vesting)
- Employee relations issues
  - Need to communicate and manage older, longer service NOC employees who may feel something has been taken away from them
  - Significant communication will be needed to educate employees on investment strategies to allow for adequate retirement income
- Cash contribution will be required each year under DC plan; no contribution holidays
- Grandfathering of some or all NOC employees will require additional costs
- DB plan doesn't "go away" as frozen benefits must continue to be administered and valued (i.e. costly), volatility of costs is still an issue

4. Continued

- May also choose to convert past service DB where cost of conversion can be costly
- No early retirement subsidy – lose vehicle to impact employee behavior (i.e. early retirement windows
- DC SERP is now considered fully funded versus unfunded in DB arrangement
- Potential workforce issues (retention issues)
  - No natural retirement points in DC plan (like age 62 in the NOC plan), so participants may be inclined to remain in service longer than expected
  - If participants have not successfully managed retirement funds, they may stay working longer than NOC wishes

(b) **Recommendation for Proposal 1**

Meets company objectives
- Covering all employees under single plan
- Avoids maintenance and costs associated with two plans

Allowing retention of longer service employees
- Maintaining the DB plan allows NOC to retain current talent through early retirement subsidies and vesting requirements

Protecting legacy of NOC employees
- NOC is protecting employees who are at or near retirement age from significant loss of retirement benefits

Costs
- Continuing the DB structure allows NOC to continue to efficiently provide a certain level of retirement income to its employees

Recommendation for Proposal 2

Addresses key issues
- Covering all employees under a single plan
- All employees will be covered under the new DC plan as the NOC DB plan will be phased out over time

Addressing cost volatility
- DC plans experience less cost volatility year-over-year since liabilities are not contingent on interest rates
- This lower cost volatility may be at the expense of providing higher retirement income give the level of cost

4. Continued

Attract new hires

- More mobile employees since benefits are earned more quickly under DC plans
- DC plans are also easier to communicate to employees
- Typically more appreciated by most employees even if they may not be equal in value to a DB plan

Shift responsibility for retirement to employee

- Asset risk is borne by the employee
- Benefits are typically not subsidized
- If the DC plan is a match based-plan, then not only is the employee responsible for managing the investments, but also is required to save their own money in order to earn any benefit from NOC
- A move to a DC plan will require substantial employee communications and education

Protecting legacy NOC benefits

- Can provide grandfathering to a select group of employees based on age/service for a certain period of time
- Another approach to protecting some of the accrued retirement income from the effects of inflation would be to grant pay run-up on past service benefits for the NOC DB plan
- Could also provide a tiered DC structure to provide higher contributions for higher ages

5. Learning Objectives:

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

Learning Outcomes:

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

Sources:

D123-07 Evaluating Portfolio Performance

D129-09 – How the Liability Benchmark is Developed and Used in Practice

Allen Ch. 24

Grader Commentary:

In this question, candidates were asked to evaluate the performance of a pension fund investment manager. A well-prepared candidate would be able to calculate the fund/benchmark performance for 2008 and 2009, and perform the calculations of the performance attribution analysis components. Finally, in addition to listing the characteristics of a market index, a well-prepared candidate would be able to recognize the characteristics of a liability that meets the market index definition.

Solution:

(a)

2008 Fund	-0.30*0.41 + -0.26*0.19 + 0.08*0.32 + 0.01*0.02 = -0.146	
2009 Fund	0.33*0.47 + 0.25*0.25 + 0.02*0.26 + 0.02*0.02 = 0.2232	
	(1-0.146)*(1+0.2232)-1 = 0.0446	(1+0.0446) ^ 0.5 - 1 = 0.0221
2008 Benchmark	-0.33*0.5 + -0.24*0.15 + 0.06*0.35 + 0.03*0 = -0.18	
2009 Benchmark	0.30*0.5 + 0.22*0.15 + 0.05*0.35 + 0.01*0 = 0.2005	
	(1-0.18)*(1+0.2005)-1 = -0.0156	(1-0.0156) ^ 0.5 - 1 = -0.0078

	2008	2009	Total	Annual
Portfolio - Actual	**-14.60%**	**22.32%**	**4.46%**	**2.21%**
Benchmark	**-18.00%**	**20.05%**	**-1.56%**	**-0.78%**
Difference with Benchmark (actual)	**3.40%**	**2.27%**	**6.02%**	**2.99%**

5. Continued

(b)

		2008	2009	
Net Contributions		0.0%	0.0%	Assumptions required
Risk Free		3.0%	1.0%	
Asset Category	wi(r benchmark -f)			Sum (asset category benchmark returns - risk free returns) using policy allocation weighs
		-21.00%	19.05%	Adjust answer based on risk free assumptions
Benchmark				Sum (manager benchmark returns - asset category benchmark returns)using policy allocation weighs, Since one manager per asset category, these returns are equal
		0.00%	0.00%	
Active	wi(r fund - r benchmark)			Sum (manager active returns - manager benchmark returns) using policy allocation weights
				Actual policy is acceptable
		1.90%	0.90%	=> Policy Allocation
		1.33%	1.40%	=> Actual Allocation
Allocation	balancing item			
		1.50%	1.37%	Active management based on policy
		2.07%	0.87%	Active management based on actual

Note: no points awarded if only the formula is written without any explanation.

(c)

List	**How**
Unambiguous	Liability cash flow can be replicated using swaps.
Investable	Cash flows can be replicated using physical securities making the benchmark investable.
Measurable	Discounted cash flow can be measured on a monthly or daily basis.
Appropriate	Pension plan assets exist to pay obligations.
Reflective of Current Investment Options	The LDI portfolio manager has access to detailed information regarding the component of cash flows since it is based on different information.
Specified in Advance	Actuaries estimate CF every year providing the basis for the benchmark construction.

6. Learning Objectives:

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

Learning Outcomes:

(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.

(2c) Explain and test for limits on plan designs and features that protect participant rights.

Sources:

Canadian Pensions and Retirement Income Planning

Ontario PBA and Regs

Morneau Sobeco Handbook of Canadian Pension and Benefit Plans

Grader Commentary:

In this question, the candidate is asked to apply his/her knowledge of both the minimum standards under the Ontario Pension Benefits Act and the maximum allowable benefits under the Income Tax Act to critique a set of proposed plan provisions. A well-prepared candidate not only identified provisions that violated one of the standards, but also outlined the rules that relate to that provision.

A well prepared candidate was expected to discuss seven to nine of the provisions that were offside and explain the correct restriction under the legislation.

Solution:

<u>Eligibility</u>

Does not meet minimum regulatory condition under Ontario PBA.

Cannot have an eligibility condition based on age – contrary to human right legislation

Full-Time: Completion of 24 months of continuous employment

Part-Time: Completion of 24 months of service and:

1. Earned 35% of YMPE in 2 consecutive calendar years; or
2. Worked 700 hours in 2 consecutive calendar years

Part-time members may have earnings above 35% of the YMPE in 2 consecutive calendar years without working 700 hours in those same calendar years.

6. Continued

Lifetime Pension Benefit

Benefit may exceed maximum lifetime pension limit under the ITA.

Minimum of $2,444 (2009) or 2% of the highest average indexed compensation per year of credited service.

HAIC = average of best 3 non-overlapping 12-month periods of indexed compensation.

$2,444 limit to be indexed after 2009 in accordance with the average wage.

This limit does not apply to connected persons.

In some circumstances, the defined benefit limit is reduced by one-third (pre-1990 past service benefit restriction).

The 35 year cap has been removed.

Plan benefit will exceed the 2% of HAIC rule if HAIC is:

$\$30/.02\times12=18000$

$\$35/.02\times12=21000$

$\$40/.02\times12=24000$

$\$45/.02\times12=27000$

PA based on assumption that member retires at end of year.

PSPA may be required each year due to increasing benefit rates

PSPA: If the pension is determined using only one flat benefit rate; and the new flat benefit per year of service is not greater than 40% of the DB limit for that year then a PSPA is created but equal to zero if flat benefit rate does not increase beyond the greater of:

- The benefit rate just prior to the increase plus $1.50 per month multiplied by the number of year (including factions) since the last increase; and
- Any flat benefit rate that was effective on or after January 1, 1984 increase by the change in AIW from that year to the year of increase.

Bridging Benefits

Plan bridge max exceeds maximum ridge allowed for members with short service.

Plan may provide a bridging benefit to age 65.

If the member is age 60 with 10 years of pensionable service, then maximum bridge is CPP + OAS for month of commencement.

CPP benefit is the max CPP benefit for commencement year $\times$ min (BAE3/YMPE3, 1).

Maximum bridge is reduced by 3%/year commencement precedes age 60.

Maximum bridge is prorated for pensionable service less than 10 years.

Maximum Lifetime + Bridge Benefit = ITA DB limit$\times$CS + 25%$\times$YMPE3 * min (CS, 35)/35

Normal Retirement Age

The current normal retirement age is compliant with the minimum standards.

The normal retirement date shall not be later than one year after the attainment of sixty-five years of age.

6. Continued

Early Retirement Age

Plan Earliest Retirement Date does not provide for all members within 10 years of their Normal Retirement Date to receive an early retirement pension.

The Earliest Retirement Date should be age 55 based on the Normal Retirement Date of the plan.

Early Retirement Reduction

The plan is unreduced at age 58 regardless of service. This will exceed the required reduction under the ITA for members with less than 22 years of eligibility service.

Early retirement pension without reduction at earlier of age 60, 30 years of eligibility service, age plus eligibility service >= 80.
(Public safety occupation – subtract 5 years.)
Must reduce by $\frac{1}{4}\%$ for each month before above.

Maximum benefit is equal to maximum lifetime limit (based on dollar limit or 2%...) reduced by above or benefit under plan, whichever is smaller.
Early retirement reduction can be no greater than actuarial equivalent.

Normal Form of Payment

Guarantee under the plan exceeds the maximum allowed.

Joint & Survivor 60% normal form required for married members not provided.

Benefits can be guaranteed for up to 15 years after the commencement of a pension.
The maximum surviving spouse pension that can be paid without a reduction is 66.67% with a 5-year guarantee (more generous option must be actuarially equivalent).
Dependent Benefits: Total monthly benefits must be less than what member would have received.
Joint & Survivor 60% is the required normal form of benefit for members with a spouse at retirement. This can be provided on an actuarially reduced basis. Member and spouse can waive their right to this normal form.

Pre-Retirement of Death Benefits

The pre-retirement death benefit is compliant with the minimum and maximum standards.

Benefit to spouse must not exceed the projected retirement benefit which equals max (accrued pension, min (projected to 65(but assuming no increases in pay), 1½ $\times$ YMPE at death)).
If minimum standards death benefit greater than above, can pay minimum standard benefit if CV paid to spouse is less than member's CV and pension starts before 69 (now 71).
Pre-retirement survivor payments can be guaranteed up to 15 years and can be indexed in line with CPI.

6. Continued

Lump sum payments are allowed provided the CV is less than the CV of the member's accrued pension, subject to minimum standards surrounds return of contributions with interest (pre-1987) and the 50% cost-sharing rule (post-1986).
The minimum requirement for benefits accrued after December 31, 1986 is either a lump sum equal to the commuted value of the deferred pension or an immediate or deferred pension equal to or greater in value as the deferred pension.
The commuted value is calculated in accordance with the CIA commuted value basis.

Termination Benefits
The termination benefit does not provide for a deferred pension option as required under the PBA.
The termination benefit should be subject to locking-in rules required under the PBA.
The member is entitled to receive a deferred pension equal to the accrued benefit at retirement.
The member can retire early from a deferred benefit provided they are within 10 years of normal retirement.
The member is entitled to transfer the commuted value of the deferred pension, subject to a minimum of a return of contributions with interest (pre-1987) and 50% cost-sharing (post-1986) from the plan
Commuted value transfers are locked-in with some exceptions (25% of pre-1987, small pension, shortened life expectancy).
The commuted value is calculated in accordance with the CIA commuted value basis

Vesting of Lifetime Pension
The current vesting schedule is compliant with the minimum standards.
24 months of membership

Post-Retirement Annual Indexation
The indexing is not compliant with the maximum standards.
Can use:
1. 4%
2. CPI changes
3. Excess earnings
4. Combination of above

If 3 or 4 used, there is additional restriction.
After pension commencement, total increases cannot exceed cumulative inc in CPI.
- Ad hoc – Just CPI increases

7. 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 the purposes of the valuation.

Learning Outcomes:

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding accounting and measuring economic value.

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

Sources:

Pension Mathematics for Actuaries, Anderson, Third Edition, 2006, Ch. 2

Grader Commentary:

A well prepared candidate will be able to calculate normal costs and accrued liabilities using the Individual Level Premium (ILP) and Aggregate cost methods. They will also be able to describe how and why normal cost accruals differ between the two cost methods.

Solution:

(a) ILP NCa = PVFBa/a(r-a) and ΔNCx = ΔPVFBx/a(r-x) where a is the age at plan inception and additional benefits arising after plan inception are funded by additional normal costs; or ILP NC = (PVFBx – ALx)/ PVFYx = (PVFBx – ALx)/ a(y-x)

Member A	PVFB2010 = 60*12 x 30 x 13 x 0.5584	0.5584
	PVFB2010 = 156797	156,797
	ä(y-x) = ä10 = (1-v10)/(1-v)	
	ä10 = 7.8017	**7.8017**
	NC2010 = (156797 - 0)/7.8017 = 20098	20,098
	NC2010 = 20098	
Member B	PVFB2010 = 60*12 x 30 x 13 x .2330	0.2330
	PVFB2010 = 65,426	65,426
	ä(y-x) = ä25 = (1-v25)/(1-v)	
	ä(y-x) = 13.5504	**13.5504**
	NC2010 = (65426 - 0)/13.5504 = 4828	4,828
	NC2010 = 4828	
Total	Total NC2010 = 24926	24,926

7. Continued

(b) ILP ALx = (ALx-1 + NCx-1) * (1+i), assuming no demographic gains or losses; or

ILP Alx = (PVFBx – PVFNCx)

AL2011 = NC2010 x 1.06	21304	
= 20098*1.06 + 4828*1.06	5118	
= 21304 + 5118 = 26422	26422	

Member A	PVFB2011 = 70*12 x 30 x 13 x 0.5919	0.5919
	PVFB2011 = 193906	193,906
	ä(y-x) = ä9 = (1-v9)/(1-v)	
	ä(y-x) = 7.2098	**7.2098**
	NC2011 = (193906 - 21304)/7.2098 = 23940	23,940
	NC2010 = 23940	
Member B	PVFB2011 = 70*12 x 30 x 13 x 0.247	0.2470
	PVFB2011 = 80910	80,910
	ä(y-x) = ä24 = (1-v24)/(1-v)	
	ä(y-x) = 13.3034	**13.3034**
	NC2011 = (80910 - 5118)/13.3034 = 5697	5,697
	NC2010 = 5697	
Total	Total NC2010 = 29637	29,637

(c)

Aggr ALx = Fx

Fx = 30,000, PVFY = Σa(y-x)

Aggr NC2011 = (PVFBx – Fx)/*PVFY* * n	274,816
Aggr NC2011 = (274816 – 30,000)/(7.2098 + 13.3034) * 2	23869
Aggr NC2011 = 23869	

(d)

- Under ILP cost of the plan for a particular year is equal to (1) the normal cost, minus (2) some amortization of the previous years' gains, where the normal cost is initially computed as a "level premium" from attained age to retirement age and is adjusted each year by additional level premiums to fund the increases in the projected pension.
- The unfunded accrued liability is zero at the beginning but could become positive if there are accumulated actuarial losses.
- The accrued liability is the present value of future benefit minus the present value of future normal costs.
- AL/NC for the plan as a whole is a sum of the individual normal costs and accrued liabilities.
- Under Aggregate cost method, the cost of the plan in any year is the normal cost. There are no additional components.

7. Continued

- The unfunded actuarial liability is 0 at all times.
- Normal cost is directly affected by the amount of contributions to the fund.
- Aggregate normal cost is lower than ILP because asset/contribution gains.
- Aggregate normal cost is lower than ILP because the younger and older members' normal costs are averaged.
- Aggregate method has higher accrued liability because by definition the accrued liability equals the total fund and includes asset/contribution gains.
- Normal cost for aggregate method is lower since the higher accrued liability reduces future costs.
- Asset/contribution gain is included in the aggregate normal cost but not in ILP NC.

8. **Learning Objectives:**

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

Learning Outcomes:

(4a) Compare different plan types and features.

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

Sources:

R-D108-07 Pension Challenges and Pension Reforms in OECD Countries

Grader Commentary:

This question requires the student to show knowledge of OECD public pension systems. The candidate will be able to demonstrate the objectives and challenges facing these systems. Candidates should be able to show knowledge of how various OECD countries have addressed the issues facing their plans. Finally, the well prepared candidate must be able to debate the merits of applying similar changes to address challenges facing the plan in their own country.

Solution:

(a)

1. Ensure pensioners have minimum standard of living
   - Compared with population as a whole
   - Absolute standard of living
   - Redistribution of wealth
   - Prevent old age poverty

2. Ensure pensioners maintain a standard of living
   - Relative to individual's employment earnings
   - Insurance or savings role
   - Adequate replacement ratio

3. Financial sustainability

(b) 1. Population aging
   - Falling fertility rates
   - Increasing life expectancy

   Proportion of population over 65 increasing
   - Increase in old-age dependency ratio
   - Double between 2000 and 2050 in OECD countries on average

8. Continued

Financial burden will increase

- Increase in government spending on old age as a percent of GDP
- Strain on programs will occur as smaller cohorts entering workforce and larger cohorts aging to retirement
- Cost increases will require taxation increases, benefit reduction, plan deficits unless changes are made early

2. (i) Change number of years used in benefit calculation
   - Extend period over which earnings are measured/use lifetime earnings
   - Impacts people with steeply rising earnings most

   (ii) Change in valorization of past earnings/pre-retirement indexation
   - Use price inflation vs. earnings inflation
   - Price inflation lower than wage inflation
   - Large impact due to compounding effect

   (iii) Change in indexation of pensions in pay
   - Increase tied to price inflation vs. wage inflation
   - Full or partial increase in price inflation
   - Preserves purchasing power
   - May have higher increase for low pension and lower increase for high pension
   - Pensioners don't share in general growth in living standards

   (iv) Link pension to higher life expectancy
   - Reduce pensions in future to reflect increases in life expectancy
   - Adjust benefits to reflect financial sustainability of system
   - Inherent in DC or notional account programs

   (v) Increase pension eligibility age
   - Equalization of age across gender
   - Adjust age for both men and women

   (vi) Increase reward for continuing to work
   - Increase penalties for early retirement
   - Increase number of years contributions required for full pension
   - Increase bonuses for deferred retirement after normal age

8. Continued

(vii) Introduce mandatory DC Plan
- Workers have option in which to plan to participate
- Public plan vs. mixed public/private
- Replace earnings related with DC (guaranteed minimum of old plan benefits)

(c) 1. Reduce indexation of pensions in pay
- Post-retirement indexation less than 100% of increase in CPI
- Will reduce future benefit costs

2. Increase pension eligibility age from 65
- Gradual increase each year for future retirements
- Will reduce number of years benefits are collected

3. Increase reward for continuing to work
- Increase early retirement reduction for 0.05%
- Increase postponed retirement adjustment from 0.05%
- Will reduce number of years benefits are collected
- Will increase contribution due to extended working period

4. Increase amount of contributions
- Increase contribution rates
- Contribute based on all earnings below YMPE
- Increase number of years of contributions required for full benefit
- Will bring in more income to program

5. Index YMPE to CPI vs. AIW
- Will reduce the benefit being provided at retirement

6. Reduce/remove additional benefits
- CPP main objective is to provide retirement income
- Refocus on main objective will decrease benefits provided

7. Increase number of years used in benefit calculation
- Maximum benefit based on more than 5 years average YMPE
- Will reduce maximum benefit

8. Increase early retirement eligibility age
- Will bring in more contributions and reduce outlay period

9. 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 the purposes of the valuation.

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

Learning Outcomes:

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding accounting and measuring economic value.

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

(6a) Evaluating actual experience, including comparisons to assumptions.

Sources:

Anderson, Pension Mathematics for Actuaries, Third Edition, 2006, Ch. 1-4, 6, 7

Morneau Sobeco, Handbook of Canadian Pension & Benefit Plans, 14th Edition, 2008, Ch. 5

A Practical Approach to Gains Analysis Revisited by Andrew Smith, Pension Section News, Sept. 93,

A Practical Approach to Gains Analysis by Josiah Lynch – TSA Vol 27 pp.423-439

R-D109-07: Financial Economics and Canadian Pension Valuation, CIA Task Force on Financial Economics

Grader Commentary:

In this question, candidates will be able to perform a valuation for an ongoing plan and describe the impact of a change in the actuarial cost method to the plan. A good paper will correctly calculate the actuarial liability and normal cost, determine the required contributions, calculate and identify the possible sources of gains and losses and provide analysis as to the impact of changing cost methods to the plan.

Solution:

(a) $AL_{1/1/2011} = AL^{A} + AL^{B}$

9. Continued

Employee A is age 33, termination decrement is end of year (i.e. at age 34)

$$CV_{34} = 2\% \times 60,000 \times 3 \times v^{(65-34)} \times 11$$
$$= 3,600 \times 1.06^{\wedge(-31)} \times 11$$
$$= 6,504$$

$$2 \times CWI_{34} = 2 \times ((2,300 + 0.5 \times 55,000) \times 1.08 + 0.5 \times 60,000) \times 1.06$$
$$= 17,922$$

$$\text{Term Benefit}_{33} = \max(CV_{34}, 2 \times CWI_{34}) / 1.06$$
$$= 16,908$$

$$AL^{A} = B^{A}{}_{33} D_{60} / D_{33} \ddot{a}_{60} = AL_{Ret} + AL_{Term}$$
$$= ((2\% \times S_{59} \times (60 - 33 + 2) \times ERF \times {}_{27}p_{33} \times v^{(60-33)} \times 12) +$$
$$(q_{33} \times \text{Term Ben}_{33}) \times 2 / 29$$
$$= 2\% \times [60,000 * (1 + 0.04)\wedge(59 - 33)] \times (29) \times 0.85$$
$$\times 0.92 \times (1.06)\wedge(-27) \times 12 + (8\% \times 16,908)) \times 2 / 29$$
$$AL^{A} = 12,948 + 93 = 13,041$$

$$AL^{B} = B^{B}{}_{60} \ddot{a}_{60} = (0.02 \times 80,000 \times 20 \times 0.85) \times 12$$
$$= 326,400$$

$$AL_{1/1/2011} = AL^{A} + AL^{B}$$
$$= 13,041 + 326,400$$
$$= 339,441$$

$$MVA_{1/1/2011} = (MVA1/1/2010 + 2010NC + \text{UAL Amortization Payments}) \times (1 + \text{fund ROR})$$

$$2010\ NC = NC^{A} + NC^{B} = 4,900 + 15,400 = \$20,300$$

$$UAL = (MVA_{1/1/201} - AL_{1/1/2010}) = (175,000 - (4,900 + 292,500))$$
$$= (122,400)$$

$$\text{UAL Amort Payment} = UAL / \ddot{a}_{\overline{15}|} =$$
$$122,400 / 10.295 = 11,889$$
$$\text{where } \ddot{a}_{\overline{15}|} \quad 10.29498$$

9. Continued

$$MVA_{1/1/2011} = (175,000 + 20,300 + 11,889) \times 1.08$$
$$= 223,764$$

(b) 2010 Gains and losses by Source
Possible sources

- Investment Gain
- Salary Loss: None for employee B as he retires at EOY with 2010 salary as expected
- Termination Loss
- Retirement Gain/Loss: There will be none as employee B retired as expected

1. Investment Gain/Loss

Actual MVA	223,764
Expected MVA	$=(175,000+20,300+11,889)\times 1.06$
	219,621
Investment Gain	=Actual MVA – Expected MVA
	4,143

AL(1) = Actual 1.1.2011 liab
AL(2) = 1.1.2011 liab using expected Sal
AL(3) = Roll forward of 1.1.2010 liab

AL(1) – AL(2) = Salary Loss
AL(2) – AL(3) = Termination Experience Loss

AL(1) 13,041 (from a)
AL(2) = Expected AL Ret + Expected AL Term
= $AL_{Ret}/60 \times 50$*13.04 + Expected AL Term
= $12,948/60 \times 52+86$
= 11,308

Exp Term Ben = $2 \times ((2,300 + 0.05 \times 50,000) \times 1.08 +$
$0.05 \times 50,000 \times 1.04) \times 1.06$
= 16,502

Exp AL Term = $16,502/1.06 \times .08 \times 2/29$
= 86

AL(3) = $(4,900+4,900) \times 1.06$
= 10,388

9. Continued

2. Salary Loss = 1,734(= 13,041 – 11,308)

3. Termination Loss = 920(= 11,308 – 10,388)

Funded Position at 1.1.2010		(122,400)
Special Payment With Interest	12,603	
Interest on Initial UAL	(7,344)	5,259
Expected Funded Position at 1.1.2011		(117,141)
Gains/(Losses):		
Investment Gain/(Loss)	4,143	
Termination Gain/(Loss)	(920)	
Salary Gain/(Loss)	(1,734)	
Miscellaneous (Due to Rounding)	(26)	1,464
Funded Position at 1.1.2011		(115,677)

(c) Impact of change in cost method to EAN effective 12.31.2010

- PUC is a benefit allocation cost method whereas EAN is a cost allocation cost method
- EAN generally has level NC as percent of salary, spreads costs evenly over employee's career
- Therefore AL in earlier years of career for EAN vs. PUC
- Results in higher AL and UAL at 1.1.2011
- EAN results in higher NC in 2011 because employee is young with low service, causing EAN to exceed PUC cost
- Results in higher SP in 2011
- Results in higher UAL at 1.1.2011
- EAN cost designed to remain stable over future working lifetime provided assumptions reflect future events
- EAN will likely result in higher levels of funding prior to retirement

10. 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.

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

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

Sources:

RD 601-07, Morneau

Grader Commentary:

The candidate will be able to describe and apply the conditions and features of a back-end flex plan. The well-prepared candidate will understand and be able to apply the Income Tax Act permissible ancillary benefits and other rules specific to back-end flex plans. The candidate will also be able to judge the merits of flex plans for individual circumstances.

A well prepared candidate would have been able to list two-thirds of the points listed in the solution to part (a), go through each of the flex calculations in part (b) to prove understanding of the rules for each benefit that could be purchased and provide commentary on which benefits to purchase and how to make adjustments to avoid forfeiture, and in part (c) to provide the advantages and disadvantages of the flex option for each member.

10. Continued

Solution:

(a)

- Contributions to a flex account must be used to purchase optional ancillary benefits.

- Contributions to a flex account may not be later used for other purposes.
- 50% employer funding rule cannot be applied to the flex contributions.
- "Use-it-or-lose-it" Rule: If a retirement or termination and individual's flex account exceeds the total value of all ancillary benefits that could possibly be purchased, the excess is forfeited.
- There is a limit on the annual contributions that a member may make in a year.
- The maximum annual contributions that a member may make in a year is the lesser of 9% of the member's earnings, and $1,000 + 70% of the member's PA MINUS any required employee contributions under the basic plan.
- The plan must set out the manner in which specific optional ancillary benefits are provided.
- A plan must not allow a member to commute the optional ancillary benefits unless the basic lifetime retirement benefit is also being commuted.
- Contributions in respect of service prior to 1990 must be identified at the time they are being paid and are limited by the pre-90 formula for contributions.
- Flex plans cannot be designated plans.
- Any information made available to plan members explaining how the plan works must be provided to CRA.

(b) **Calculations for Member A**

Age 60

Credited service at age 60 = 35

1. Cost of upgrade to Final 3-year average earnings = 35*500 = 17,500
2. Cost of unreduced pension at age 60 = 35*1,700 = 59,500
3. Cost of indexing at 1.5% = 35*2,900 = 101,500
4. Cost of joint and survivor 66 2/3% pension with 5 year guarantee = 35*2,000 = 70,000
5. Cost of bridge = 35*1,000 = 35,000

Total cost at age 60 = 283,500

Total cost at age 60 is more than flex balance of 252,000 by 31,500

Member cannot purchase all the ancillary benefits offered by the contributory provision of the plan.

10. Continued

Member may purchase any four of the ancillary benefits offered, except that he cannot have 2) + 3) + 4) + 5). The remaining flex balance can be used to purchase part of the fifth benefit.
Member may elect to purchase indexing at lower level.
Actual indexing provided capped by ITA.

Age 65
Credited service at age 65 = 40
Cost of upgrade to Final 3-year average earnings = 40*500 = 20,000
Cost of indexing at 1.5% = 40*2,600 = 104,000

Cost of joint and survivor 66 2/3% pension with 5 year guarantee = 40*2,800 = 112,000
Total cost at age 65 = 236,000
Total cost at age 65 is less than flex balance of 363,000 by 127,000.

Member can purchase all the ancillary benefits offered by the contributory provision of the plan.
Member will forfeit 127,000.

Calculations for Member B

Age 60
Credited service at age 60 = 15
1. Cost of upgrade to Final 3-year average earnings = 15*500 = 7,500
2. Cost of unreduced pension at age 60 = 15*1,700 = 25,500
3. Cost of indexing at 1.5% = 15*2,900 = 43,500
4. Cost of joint and survivor 66 2/3% pension with 5 year guarantee = 15*2,000 = 30,000
5. Cost of bridge = 15*1,000 = 15,000

Total cost at age 60 = 121,500
Total cost at age 60 is more than flex balance of 81,000 by 40,500.

Member cannot purchase all the ancillary benefits offered by the contributory provision of the plan.

Member may elect at least two of the ancillary benefits offered. The remaining flex balance can be used to partially purchase other of the ancillary benefits.
Actual indexing provided capped by the ITA.

10. Continued

Age 65

Credited service at age 65 = 20
Cost of upgrade to Final 3-year average earnings = 20*500 = 10,000
Cost of indexing at 1.5% = 20*2,600 = 52,000

Cost of joint and survivor 66 2/3% pension with 5 year guarantee = 20* 2,800 = 56,000
Total cost at age 65 = 118,000
Total cost at age 65 is less than flex balance of 134,000 by 16,000

Member can purchase all the ancillary benefits offered by the contributory provision of the plan.
Member will forfeit 16,000.

(c) Non-contributory option with Flex for Member A

- Younger employees may not earn enough to contribute towards pension plan. Flex contributions are optional.
- Younger employees may not value pension benefits as much; less important for attracting young talents.
- Lower PA's, which can then increase the RRSP contribution room for younger employees who want to manage their own investments or invest more aggressively to benefit from potential higher investment returns in the RRSP account.
- Can get PAR when terminates.

Flex Advantages

- Tax deferred contributions.
- Does not increase PA's while improving pension benefits.
- Flexibility in contributions: The member contributed only when he/she can afford it and in the amount he/she chooses.
- Member chooses ancillary benefits at retirement depending on own needs and situation.
- May benefit from potential higher investment return on Flex account to improve basic plan benefits, while the basic plan pension serves as a guaranteed minimum pension (reducing risks to the employee compared to a fully DC plan).

10. Continued

Flex Disadvantages

- "Use-it-or-lose-it" Rule: If a flex balance cannot be used towards all possible ancillary benefits, which is often the case for a member who retires at Normal Retirement Age, the flex balance must be forfeited.
- Employer can choose to refund to the employee outside of the plan any forfeited flex balance that cannot be used towards ancillary benefits, but the total payment is taxable.
- Employee must monitor annually the flex balance and the ancillary benefits that can be purchased to avoid the "Use-it-or-lose-it" situation, which adds administrative complexities to flex plans.
- Employee needs to be disciplined to save towards flex contributions otherwise he may not accumulate enough flex assets to purchase proper level of retirement benefits.

Contributory option for Member B

- More generous plan: Higher retirement pension, lower early retirement reduction, higher spousal continuation pension and guarantee period.
- Reduced risks associated with asset investment. Risk transferred to the employer.
- PA may not be overvalued as the basic plan under this option; has generous ancillary benefits.
- 50% employer funding rule on contributions and no "use-it-or-lose-it" rule.

11. 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:

D 104-07

Trend to a Global TCN Benefits Program for US Companies

Grader Commentary:

The successful candidate will remember the major points from the study note that covers multi-national pooling.

Solution:

(a) Multinational pooling enables the principles of experience rating to be applied to the worldwide insurance arrangements of a multinational company. Rather than providing benefits through separate arrangements in each country, the parent company enters into a contract with an insurance network to share the profits and losses of the network's business with the subsidiaries of the parent company. Individual contracts are negotiated between the subsidiary and the local insurer. The individual contracts conform with local laws and practices. Each subsidiary company (the multinational company's local operation in a given country) makes a premium payment to the local insurance company/financial organization in return for the agreed coverage. The premium and/or the dividend may be linked to the actual benefits/claims experience of the local subsidiary. Dividends may be paid out of the insurer's profits at the end of the year.

(b) **Advantages**

- Reduction in overall insurance/benefits cost
- Primary means of enjoying economics of scale based on worldwide group size
- Group benefits from favorable experience and bears some of the risk of bad experience
- Cost reduction from receipt of dividends
  - When experience is unfavorable, worst case is cancellation of dividend
  - Cancellation could be for several years

11. Continued

- Dividends arise from the following factors : Low claims, claims lower than average, pooling reduces risk for insurer, membership in network offers competitive advantage
- Annual accounting on centralized basis
- Centralized communication
  - Reduces administrative time and expense
- Relaxed underwriting
  - Risk of adverse experience reduced substantially, and insurance company more willing to raise/eliminate medical evidence limits

Disadvantages

- Insufficient number of ees located overseas
  - Typically, need at least 500 ees in at least 2 countries outside US and Canada
- Network's local insurer may not be competitive
- Network may not have a local representative
- In countries with blocked currencies, networks may have difficulty in pooling or in paying dividends outside the country
- Company/industry may have above average claims
- Local management may refuse to change carriers
  - Example of reason to refuse to change carrier: Excellent service from existing carrier, national pride, long standing relationship
- In some countries, premium rates are extremely low, so the insurer's profit margin is low, and the risk of adverse claims experience may outweigh the expected additional multinational dividend

12. Learning Objectives:

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

Learning Outcomes:

(6a) Evaluating actual experience, including comparisons to assumptions.

(6b) Adjust current assumptions, given past experience and trends.

(6d) Describe and explain the differences between a traditional and a financial economics perspective on the selection of assumptions

Sources:

Yamamoto Ch. 9

ASOP 27

ASOP 35

CSOP General

Mercer Resource Manual on Selection of Assumptions

Grader Commentary:

This question is in two parts, the first one asking for a list of factors to consider in selecting going concern assumptions and the second part requiring the candidate to understand how these factors are affected by a significant reduction in membership. For part (a) of the question, a well prepared candidate will be able to list most major factors to consider in selecting going concern assumptions as well as some minor factors. For part (b) of the question, a well prepared candidate will be able to analyze and explain the impact of a significant reduction in membership on the selection of going concern assumptions.

Solution:

(a) **<u>General Assumption Selection Considerations</u>**

Assumptions must be consistent with one another
Within best estimate range for each assumption (individually reasonable)
Provision for adverse deviation
Materiality of each assumption
Characteristics of the covered group
Purposes of the measurement
Factors that may affect future experience
Characteristics of the obligation
Statutes or regulations
Contingencies that give rise to benefits or result in loss of benefits
Sources of information available

12. Continued

Cost effectiveness
Combined effect of assumptions
Advice of experts
Expected plan termination

(i) **Considerations Specific to the Discount Rate**
Historical return for each asset category
Expectations of future return for each asset class
Consistency amongst pieces of building block
Expenses
Investment policy
Reinvestment policy/portfolio rebalancing
Diversification
Investment volatility
Investment manager performance
Cash flow timing
Benefit volatility
Expected plan termination
Active vs. passive management
Tax status of funding vehicle

(ii) **Considerations Specific to Salary Increase Assumption**
Historical increase
Membership characteristics
Compensation practice
Competitive factors
Collective bargaining
Compensation volatility

(iii) **Considerations Specific to Retirement Age Assumption**
Plan provisions – Early retirement incentives, actuarial equivalent
Past experience and credibility of experience
Trends – Economic, societal
Non-pension retirement incentives
Payout options – Higher for plans with lump sum option
Availability of social security
Availability of retiree medicare
Special factors – Early retirement windows, reduction inforce, financial strength of company

12. Continued

(iv) **Consideration Specific to Mortality Assumption**

Future mortality improvements
Size of plan – Is experience credible?
Industry/Occupation
Appropriateness of sub-groups, different mortality rates by sub-group

(b) **Discount Rate/Investment Return**

The discount rate may need to be changed:

- If there are changes to the Statement of Investment Policies
- The duration is likely greater given that all pensioners have been settled
  - Was the SIP modified to reflect this change?
  - If so, the discount rate should be modified accordingly
- If in the past expenses were implicitly reflected in the discount rate, adjust according
  - The plan is now much smaller and expenses may be a greater portion of assets
  - Investment management fees may have been increased by the fund manager given the much smaller fund

Salary Increase

Must look at past experience of the smaller group, not experience of prior group

- The remaining group may have significantly different experience than prior group

Look at the characteristics of the remaining group
Is the remaining group unionized?

- If so, reflect the Collective Bargaining Agreement in the assumption

Mortality

Should be based on the new group

- Is there a reason to change the assumption, such as type of work?

Is experience credible or relevant after PW?

Retirement

Difficult to look at past experience given that the group is much smaller
It may be necessary to base the assumption on expectations
Consider other programs available to this group, such as health plan
Is experience credible or relevant after PW?

12. Continued

General

Are new assumptions still consistent with one another?
Are new assumptions still individually reasonable?
Look at materiality of some of the assumptions given the group size (termination scale, pre-retirement mortality)
Are plan provisions different for the new group?
Should consider cost effectiveness

13. Learning Objectives:

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

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

Learning Outcomes:

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

(2c) Explain and test for limits on plan designs and features that protect participant rights.

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

Sources:

Anderson, Pension Mathematics for Actuaries, Third Edition, 2006, Ch. 1-4, 6, 7

R-D600-10: Ontario Pension Benefits Act R.R.O 1990, Regulation 909 (Financial Services Commission of Ontario)

R-D612-10: Ontario Pension Benefits Act R.S.O. 1990, Chapter 8

R-D609-07: Pension Funding Exercises (background only)

Grader Commentary:

In this question, candidates were asked to demonstrate their understanding of different cost methods (EAN and PUC) and recognize that the company funding policy uses a different cost method than the statutory requirements. They must calculate contributions under both cost methods to determine whether the company funding policy is compliant with the statutory requirements. Candidates were also asked to demonstrate their knowledge of Ontario statutory funding requirements. A well prepared candidate would know Ontario funding valuation requirements as well as know the difference in cost methods and understand why the funding policy contributions need to be tested against the contributions for statutory requirements.

Solution:

(a) **Step 1: Perform Going Concern Valuation Under EAN Cost Method**

e = entry age

r = retirement age

13. Continued

Going Concern Normal Cost Under EAN Cost Method

$NC_e = PVFB_e / PVFS_e$

$PVFB_e = B_{(r)} \ddot{a}_r^{(12)} v^{(r-e)}{}_e p_r$

$B_{(r)} = 1.4\% \times \text{Final Salary}_{(r-1)} \times ERF \times \text{CreditedService}$

$PVFS_e = \ddot{a}_{(r-e)\,j}$

$j = (1 + \text{Discount Rate}) / (1 + \text{Salary Scale}) - 1$

Normal Cost

$NC_{32} = B_{(55)} a_{\ 55}$ $NC_{32} = B_{(55)} \ddot{a}_{55}{}^{(12)} v^{23}{}_{32} p_{55} / \ddot{a}_{23\,j}$

$B_{(55)} = 1.4\% \times 85,000 * (1.03)\text{^}(54-45) \times 23 \times 0.97$

$= \$34,640$

$\text{Points}_{(55)} = 55 + 23 + 78 (\text{ERF is .25\% per month from 80 points} = 1 - .0025 * 12 = .97)$

$PVFB_e = 34,640 \times 13.1 * (1.06)\text{^} - 23 \times 1$

$= 118,800$

$PVFS_e = \ddot{a}_{23\,j} = (1 - (1/1 + j/12)^{\text{^}276}) / j$

$j = (1.06)/(1.03) - 1 = 2.91\%$

$= 16.74870$

$NC_{32} = 118,800 / 16.74780$

$= 7,093$

$NC_{45} = NC_{32} \times (1.3\%)^{13}$

$= 10,416$

Going Concern Unfunded Liability Calculation Under EAN

$AL = PVFB_{@1.1.2010} - PVFNC_{@1.1.2010}$

$PVFB_{45} = 1.4\% \times 85,000 * (1.03)^{\text{^}(54-45)} \times 23 \times 13.1 \times 0.97 * (1.06)^{\text{^}-10}$

$= 253,393$

$PVFNC_{45} = NC_{45} \times PVFS_{45}$

$PVFS_{45} = \ddot{a}10\,j = (1 - (1/1 + j/12)^{\text{^}120}) / j$

$= 8.66630019$

$PVFNC_{45} = 10,416 \times 8.66630019$

$= 90,268$

$AL_{45} = 253,393 - 90,268$

$= \$163,125$

13. Continued

Going Concern Financial Position
The market value of assets at January 1, 2010 is $50,000

GC Position: Assets at January 1, 2010 – Liability at January 1, 2010
= $50,000 - $163,125
= ($113,125) Deficit

Step 2: Calculate Cash Contributions Based on Funding Policy

Special Payments are to be made over a 5 year period.

$$a_5 = (1-(1/1+i/12)\text{^}60/i = (1-(1/(1+0.06/12)^{\text{^}60}/0.06$$
$$= 4.31046$$

Annual Special Payment = GC unfunded Liability/a_5
$$= 113{,}125/4.310463$$
$$= 26{,}244$$

Cash Contributions = Total Normal Cost_{EA} + Unfunded Going Concern Liabilities over a 5 year period
$$= 10{,}416 + 26{,}244$$
$$= 36{,}660$$

(b) **Step 3: Calculate Contributions Based on Minimum Regulatory Funding Requirement (Ontario)**

Minimum Regulatory Funding Requirement = NC(GC) + Unfunded GC Liability Funded Over 15 Years + Solv Deficiency Funded Over 5 Years

Going Concern Financial Position of the Plan as at January 1, 2010 (Using PUC)

$$B_{(45)} = 1.4\% * \text{Final Salary at } 55 * \text{ Service at Jan } 1,2010 * \text{ERF}$$
$$B_{(45)} = 1.4\% * 85{,}000 \times (1.03)\text{^}(54-45) * 13 \times 0.97 = \$19{,}579$$
$$AL_{45} = B_{45}\ddot{a}_{55}^{(12)}v^{10}{}_{45}p_{55}$$
$$AL_{45} = 19{,}579 * 13.1 * 0.558395$$
$$= \$143{,}222$$

13. Continued

Going Concern Financial Position (PUC)
The market value of assets at January 1, 2010 is $50,000
GC position = Assets at January 1, 2010 – Liability at January 1, 2010

$$= \$50,000 - \$143,222 = (\$93,222) \text{ deficit}$$

$$= (\$93,222) \text{ deficit}$$

Normal Cost Member

$$NC_{45} = AL_{45} / \text{Service at } 1.1.2010$$

$$NC_{45} = \$143,222/13 = \$11,017$$

Going Concern Special Payments
Special Payments are to be made over a 15 year period

$$a_{15} = (1-(1/1+i/12)^{\wedge 180}/i = (1-(1/(1+0.06/12)^{\wedge 180}/0.06$$

$$= 9.87529292$$

$$= \$93,222/9.875293$$

$$= \$9,440 \text{ Annual Payment}$$

Solvency Financial position of the Plan as at January 1, 2010

Liability Calculation (UC)
Age that maximizes the liability = 55

$$AL = 1.4\% * Sal_{45} * svc_{45} * \ddot{a}55^{(12)} 4.2\%/5.3\% = v10*(1-ERF)$$

$$AL = 1.4\% * 85,000 * 13 * 15.2 * ((1-3\%) * 0.662709$$

$$AL = \$151,157$$

Solvency Financial Position
The Market value of assets at January 1, 2010 is $50,000.

The solv asset adj is the PV of the already established APt schedules for the next 5 years.
At the 1.1.2010 val, A GC amort schedule of $9,440 per year was established or $9,440 * a5.

$$a5 = (1-(11+i12)^{\wedge}60)i$$

$$a5 = (1-(1/(1+0.042/12)^{\wedge}60)/0.042$$

$$a5 = 4.502821471$$

The solvency asset adjustment is $9,440 * 4.502821471

$$= \$42,507$$

13. Continued

Solv position = MVA 1.1.2010 + solv asset adj – WU expense – solve liability 1.1.2010
= $50,000 + $42,507 - $10,000 - $151,157
= ($69,650) (deficit)

Solvency Special Payments
Special Payments are to be made over a 5 year period.
= $68,650/4.502821471
= $14,580 Annual Payment

Minimum Compliance (using PUC) = $11,017 +9,440 + 14,580 = $35,037

Step4: Determine If Any Adjustments Need To Be Made To Minimum Contribution for 2010

Minimum regulatory compliance (NC and SP) is lower than under Funding Policy.
Cash Contributions for 2010 = $36,660