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| <b>10a. Evaluate the interaction of plan investment and:</b> <ul style="list-style-type: none"> <li>▪ Plan design and funding</li> <li>▪ Valuation assumptions and methods</li> </ul>                                          |        |
| <i>R-D120-07 Asset / Liability Modeling and Asset Allocation for Pension Plans</i>                                                                                                                                             | 1      |
| <i>R-D129-09 How the Liability Benchmark is Developed and Used in Practice</i>                                                                                                                                                 | Obj6j  |
| <i>R-D131-09 Plan Sponsor Guide to Liability-Driven Investment Strategies</i>                                                                                                                                                  | 12     |
| <i>R-D132-09 Top 10 Myths about Liability – Driven Investing</i>                                                                                                                                                               | 13     |
| <b>10b. Solve for a measure of investment performance relevant to a given benchmark</b>                                                                                                                                        |        |
| <i>Retirement Plans (10<sup>th</sup> Edition) by Allen et al</i><br>Chapter 24: Defined Benefit Plan Investment Management                                                                                                     | 15     |
| <i>Handbook of Canadian Pension and Benefit Plans (14<sup>th</sup> Edition) by Morneau Sobeco</i><br>Chapter 6: Pension Fund Investment Management                                                                             | 19     |
| <i>R-D-123-07 Managing Investment Portfolio, Maginn and Tuttle, 3<sup>rd</sup> Edition, Chapter 12</i>                                                                                                                         | 24     |
| <i>R-D129-09 How the Liability Benchmark is Developed and Used in Practice</i>                                                                                                                                                 | Obj6j  |
| <b>10c. Given a context, describe and compare the structure of appropriate investment vehicles</b>                                                                                                                             |        |
| <i>Retirement Plans (10<sup>th</sup> Edition) by Allen et al</i><br>Chapter 24: Defined Benefit Plan Investment Management, Page 438 – 447 [Classes of Assets; Selecting an Investment Manager; Passive Vs. Active Management] | Obj10b |
| <i>Handbook of Canadian Pension and Benefit Plans (14<sup>th</sup> Edition) by Morneau Sobeco</i><br>Chapter 6: Pension Fund Investment Management                                                                             | Obj10b |
| <i>R-D-124-11 Introduction and Overview of Retirement Plan Investment</i>                                                                                                                                                      | 36     |
| <i>R-D133-09 Maginn and Tuttle Chapter 8, Section 6: Hedge Funds</i>                                                                                                                                                           | 40     |

| Instructional Objective 11                                                                                                                  | Page       |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>11a. Explain and apply the Guides to Professional Conduct</b>                                                                            |            |
| <b>11e. Recognize situations and actions that violate or compromise standards or guides to professional conduct</b>                         |            |
| <b>11f. Recommend a course of action to repair a violation of the Standards or the Guides to Professional Conduct</b>                       |            |
| <i>CIA Code of Professional Conduct</i>                                                                                                     | 1          |
| <i>SOA Code of Professional Conduct</i>                                                                                                     | 4          |
| <b>11b. Explain and apply the relevant qualification standards</b>                                                                          |            |
| <i>CIA Qualification Standards</i>                                                                                                          | 9          |
| <i>SOA Qualification Standards</i>                                                                                                          | 12         |
| <b>11c. Demonstrate knowledge of requirements regarding the actuary's responsibilities to participants, plan sponsors, etc</b>              |            |
| <b>11d. Explain and apply all the applicable standards of practice related to valuing retirement obligations</b>                            |            |
| <i>CIA Code of Professional Conduct</i>                                                                                                     | Obj11a/e/f |
| <i>SOA Code of Professional Conduct</i>                                                                                                     | Obj11a/e/f |
| <i>R-D125-11 ASOP35 Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations</i>                        | Obj6c      |
| <i>R-D126-09 ASOP27 Selection of Economic Assumptions for Measuring Pension Obligations</i>                                                 | Obj6c      |
| <i>R-D127-09 ASOP6 Measuring Retiree Group Benefit Obligations</i>                                                                          | Obj5b      |
| <i>R-D130-09 ASOP23 Data Quality</i>                                                                                                        | Obj7       |
| <i>R-D134-09 ASOP 2 Recommendations for Actuarial Communications Related to Statements of Financial Accounting Standards Nos. 87 and 88</i> | 14         |
| <i>R-D135-09 ASOP 4 Measuring Pensions Obligations</i>                                                                                      | 15         |
| <i>R-D613-11 CSOP 1000 – 1800, February 2011</i>                                                                                            | Obj5d      |
| <i>R-D614-11 CSOP 3000 – 3500, December 2010</i>                                                                                            | Obj2e      |

**Fundamentals of Retiree Group Benefits (Yamamoto et al)**

**Page 287 - 294**

**I. ACTUARIAL METHODS FOR LIFE AND HEALTH PLANS**

1. All pension actuarial cost methods applicable to retiree group benefit plans.
2. Only difference is benefit definition
  - a) Benefit related to health plan costs at retirement + cost increases after retirement.
  - b) No benefits EE terminating before eligible for retirement
  - c) Benefit costs / retiree contributions vary on service, age, and marital status at retirement.
3. May split costs associated with total eligible health plan expenses and those reimbursed by Medicare
  - a) Net present value cost of the plan = PV of total eligible expenses less PV of Medicare reimbursed expenses:

$$PVTH_x = \frac{\sum_j^{\infty} l_j \times {}^r q_j \times B_j \times T_{\&#8226;j} \times v^{j-x}}{l_x}$$

$$PVM_x = \frac{\sum_j^{64} l_{65} \times {}^r q_j \times M_{65} \times M_{\&#8226;65} \times v^{65-x}}{l_x} + \frac{\sum_j^{\infty} l_j \times {}^r q_j \times M_j \times M_{\&#8226;j} \times v^{j-x}}{l_x}$$

$$PVNH_x = PVTH_x - PVM_x$$

where:

- $PVTH_x$  = present value of total health plan benefit
- $l_j$  = number alive at age  $j$
- ${}^r q_j$  = probability of retirement at age  $j$
- $B_j$  = benefit at age  $j$  (increased at total health trend assumption from age  $x$ )
- $T_{\&#8226;j}$  = increasing annuity at age  $j$  (increasing at total health trend assumption)
- $v^{j-x}$  = interest discount
- $PVM_x$  = present value of Medicare benefit
- $M_j$  = Medicare benefit at age  $j$  (increased at Medicare increase assumption from age  $x$ )
- $M_{\&#8226;j}$  = increasing annuity at age  $j$  (increasing at Medicare increase assumption)
- $PVNH_x$  = present value of net health plan benefit
- $B_j, M_j$  = present benefits payable at the attained age  $j$  and therefore include any health/Medicare inflation from age  $x$

Modified Projected Unit Credit

1. Required “attribution” method under FAS 106
2. Since retiree group benefits has no rate of benefit accrual, method must be modified
3. FAS 106 requires benefits be attributed to years prior to the date of full eligibility for benefits instead of expected retirement dates.
  - a) E.g. EE hired at 35 with full benefit accrual by earliest retirement age 55.
  - b) EE is assumed to have accrued one-fourth  $[5 \div (55 - 35)]$  of his benefit at age 40, three-fourths at 50  $(15 \div 20)$  and the full benefit at age 55

Delayed Funding Eligibility

1. Applicable to any actuarial method
2. The difference is only participants who meet high age and service requirements will be included in the calculations. (E.g. Age 45 with 15 years of service or a rule of 60)
3. Rationale: only value EE most likely to receive retiree group benefit
4. Provide some degree of advance accrual for ER

Modified Entry Age

1. For welfare benefit fund calculations.
2. Entry age = Max (age at hire, date the welfare benefit fund was adopted)
  - a) Benefits funded over the working lifetime of employees

**II. SELECTION OF ACTUARIAL METHODS**

1. FAS 106 requires projected unit credit method with cost allocation from hire age to full eligibility age (typically earliest retirement age)
  - a) Cost allocation may also be over different time periods depending on how benefits are earned.
2. Most conservative (fastest) funding form entry age normal method
3. Most liberal (slowest) funding from traditional unit credit method
4. In between from aggregate, frozen initial liability, and projected unit credit methods
  - a) Depend on amortization period of any unfunded liability in the funding amount.
5. GASB allow all 6 methods: entry age, attained age, frozen entry age, frozen attained age, projected unit credit, and aggregate.
  - a) Actuary must communicate the longer term differences of the alternative methods.
6. Pension literature on actuarial cost methods selection generally also applicable for retiree group benefit valuations

**III. EXPERIENCE GAINS AND LOSSES**

1. Immediate gain methods (entry age and unit credit) produce annual GL
2. Generalized formula for calculating the gain/loss is:

$$Exp\ UAL_{t+1} = (UAL_t + NC_t) \times (1+i) - C_t^i$$

$$Gain/(loss) = Exp\ UAL_{t+1} - UAL_{t+1}$$

where:

|                  |   |                                       |
|------------------|---|---------------------------------------|
| $Exp\ UAL_{t+1}$ | = | Expected unfunded actuarial liability |
| $UAL_{t+1}$      | = | Actual unfunded actuarial liability   |
| $NC_t$           | = | Normal cost                           |
| $i$              | = | interest rate                         |
| $C_t^i$          | = | Contribution (with interest)          |

3. GL may be identified by each source E.g. GL due to plan cost changes:

$$Gain/(loss) = AL_{t+1} - \frac{PC_t \times (1+m)}{PC_{t+1}} \times AL_{t+1}$$

where:

|        |   |                       |
|--------|---|-----------------------|
| $PC_t$ | = | plan cost at time $t$ |
| $m$    | = | expected health trend |

4. Pension literature on GL also applicable for retiree group benefit valuations

#### IV. “ROLL-FORWARD” VALUATIONS

1. Allowed by ASOP 6 for interim valuations
2. Expected actuarial liability (no GL):

$$Exp\ AL_{t+1} = (AL_t + NC_t) \times (1+i) - B_t^i$$

3. May adjust expected AL if actual claim rates is different from prior year's claim rate increased by the valuation health care cost trend rate assumption.
  - a) Linear adjustment is generally used (I.e. if the actual increase in cost rate was  $j\%$  and the expected increase was  $i\%$ , adjustment is:

$$Adj\ AL_{t+1} = Exp\ AL_{t+1} \times \frac{1+j}{1+i}$$

4. Similar adjustment may be made for demographics
  - a) Either total number or a change in the make-up (i.e., age and gender)
  - b) Consider differences by group (i.e., actives versus pre- and post-65 retirees), plan type, and location.
5. Normal cost estimation generally = Prior year's normal cost increased by the ultimate trend rate:

$$PVB_x^z = \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^z \times \prod_{j=0}^{t-1} (1+h_{z+j})$$

where:

|            |   |                                         |
|------------|---|-----------------------------------------|
| $PVB$      | = | present value of projected benefits     |
| ${}_t p_x$ | = | probability of survival to duration $t$ |
| $r_{x+t}$  | = | probability of being retired at $x+t$   |
| $B_0^z$    | = | initial benefit amount in year $z$      |

$$h_{z+j} = \text{health care trend in year } z + j$$

$$PVB_x^{z+1} = \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^{z+1} \times \prod_{j=0}^{t-1} (1+h_{z+1+j})$$

$$B_0^{z+1} = B_0^z \times (1+h_z)$$

$$PVB_x^{z+1} = \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^z \times (1+h_z) \times \prod_{j=0}^{t-1} (1+h_{z+1+j})$$

$$PVB_x^{z+1} = \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^z \times \prod_{j=0}^t (1+h_{z+j})$$

$$PVB_x^{z+1} = \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^z \times (1+h_{z+t}) \times \prod_{j=0}^{t-1} (1+h_{z+j})$$

6. If most persons aged  $x$  benefits do not commence until after the select period (i.e., time  $t$  is beyond the select period), the term  $h_{z+t}$  is a constant equal to the ultimate trend rate  $h_{ult}$ .

$$PVB_x^{z+1} = (1+h_{ult}) \times \sum_{t=0}^{\infty} {}_t p_x \times r_{x+t} \times B_0^z \times \prod_{j=0}^{t-1} (1+h_{z+j})$$

$$PVB_x^{z+1} = (1+h_{ult}) \times PVB_x^z$$

$$NC_x^z = PVB_x^z \times \frac{1}{FEA - e}$$

$$NC_x^{z+1} = PVB_x^{z+1} \times \frac{1}{FEA - e}$$

therefore:

$$NC_x^{z+1} = NC_x^z \times (1+h_{ult})$$

Above illustrates the formula for the projected unit credit method normal cost development. Similar proofs can be made for other actuarial cost methods

7. For select period  $> 5$  years, such assumption (Most active EE start benefit payments until after the select period) does not hold
- Decide how much greater the service cost should be increased over the ultimate trend rate assumption.
8. Stable population implies total NC increases at the ultimate health care trend rate.