Retirement Gains:

Example:

Plan Provisions:

Retirement benefit:	2% of final earnings per year of credited service
Normal form of payment:	Life Only, payable monthly in advance
Normal retirement age:	Age 65
Unreduced retirement age:	Age 62
Early retirement reduction:	4% for each year prior to unreduced retirement age
Termination benefit:	Deferred pension payable at age 65, or actuarial equivalent if received earlier
Pre-retirement death benefit:	Actuarial present value of deferred pension payable from when the member would have attained age 65

Actuarial Assumptions and Methods:

Interest rate:	5% per year
Salary increase rate:	3% per year
Actuarial cost method:	Projected Unit Credit, prorated on service
Pre-retirement mortality:	None
Termination rates:	10% at age 50
Retirement rates:	See table below
Timing of decrements:	Beginning of year

Retirement Rates:

Age	Retirement
55	25%
62	50%
65	100%

Annuity Factors:

$\ddot{a}_{50}^{(12)}$	16.7
$\ddot{a}_{55}^{(12)}$	15.8
$\ddot{a}_{62}^{(12)}$	14.2
$\ddot{a}_{65}^{(12)}$	13.3

Member Data as at December 31, 2017:

	Member A	Member B
Age	50	61
Earnings for 2017	$80,000	$100,000
Credited Service	10 years	14 years

(a) Calculate the accrued liability and normal cost at December 31, 2017 for each member.

Show all work.

You are given:

- Member A receives a salary increase of 7% at December 31, 2018.
- Member B died on December 31, 2018. As of December 31, 2018, the death benefit has not been paid.

(b) Calculate the accrued liability at December 31, 2018 for each member.

Show all work.

(c) Calculate the gains and losses by source for 2018.

Solution:

(a)

Member A

AL at Dec. 31, 2017 = AL (term 50) + AL (ret 55) + AL (ret 62) + AL (ret 65) = **$162,135**

AL (term 50) = $0.10 \times 2\% \times \$80{,}000 \times 10 \times 13.3 \times (1.05)^{-(65-50)} = \$10{,}236$

AL (ret 55) = $0.90 \times 0.25 \times 2\% \times \$80{,}000 \times (1.03)^{(55-50)} \times 10 \times 15.8 \times (1.05)^{-(55-50)} \times [1 - 0.04 \times (62 - 55)] = \$37{,}199$

AL (ret 62) = $0.90 \times 0.75 \times 0.5 \times 2\% \times \$80{,}000 \times (1.03)^{(62-50)} \times 10 \times 14.2 \times (1.05)^{-(62-50)} = \$60{,}878$

AL (ret 65) = $0.90 \times 0.75 \times 0.5 \times 2\% \times \$80{,}000 \times (1.03)^{(65-50)} \times 10 \times 13.3 \times (1.05)^{-(65-50)} = \$53{,}823$

NC at Dec. 31, 2017 = NC (term 50) + NC (ret 55) + NC (ret 62) + NC (ret 65) = **$15,190**

NC (term 50) = $0

NC (ret 55) = $0.90 \times 0.25 \times 2\% \times \$80{,}000 \times (1.03)^{(55-50)} \times 1 \times 15.8 \times (1.05)^{-(55-50)} \times [1 - 0.04 \times (62 - 55)] = \$3{,}720$

NC (ret 62) = $0.90 \times 0.75 \times 0.5 \times 2\% \times \$80{,}000 \times (1.03)^{(62-50)} \times 1 \times 14.2 \times (1.05)^{-(62-50)} = \$6{,}088$

NC (ret 65) = $0.90 \times 0.75 \times 0.5 \times 2\% \times \$80{,}000 \times (1.03)^{(65-50)} \times 1 \times 13.3 \times (1.05)^{-(65-50)} = \$5{,}382$

Member B

AL at Dec. 31, 2017 = AL (ret 62) + AL (ret 65) = **$367,427**

AL (ret 62) = $0.5 \times 2\% \times (1.03)^{(62-61)} \times \$100{,}000 \times 14 \times 14.2 \times (1.05)^{-(62-61)} = \$195{,}013$

AL (ret 65) = $0.5 \times 2\% \times \$100{,}000 \times (1.03)^{(65-61)} \times 14 \times 13.3 \times (1.05)^{-(65-61)} = \$172{,}414$

NC at Dec. 31, 2017 = NC (ret 62) + NC (ret 65) = **$26,245**

NC (ret 62) = $0.5 \times 2\% \times (1.03)^{(62-61)} \times \$100{,}000 \times 1 \times 14.2 \times (1.05)^{-(62-61)} = \$13{,}930$

NC (ret 65) = $0.5 \times 2\% \times \$100{,}000 \times (1.03)^{(65-61)} \times 1 \times 13.3 \times (1.05)^{-(65-61)} = \$12{,}315$

Alternate solution: Since there is no assumed decrement in the beginning of the first year, then use the formula AL at Dec. 31, 2017 / Credited Service at Dec. 31, 2017 = $367,427 / 14 = **$26,245**

(b)

Member A (Age 51)
Earning 2018 = $80,000 * 1.07 = $85,600

AL at Dec. 31, 2018 =AL (ret 55) + AL (ret 62) + AL (ret 65) = **$202,508**

AL (ret 55) = $0.25x2\% \times \$85,600 \times (1.03)^{(55-51)} \times 11 \times 15.8 \times (1.05)^{-(55-51)} \times [1- 0.04 \times (62-55)] = \$49,593$
AL (ret 62) = $0.75 \times 0.5 \times 2\% \times \$85,600 \times (1.03)^{(62-51)} \times 11 \times 14.2 \times (1.05)^{-(62-51)} = \$81,160$
AL (ret 65) = $0.75 \times 0.5 \times 2\% \times \$85,600 \times (1.03)^{(65-51)} \times 11 \times 13.3 \times (1.05)^{-(65-51)} = \$71,755$

Member B (Age 62)
Earning 2018 = $100,000 * 1.03 = 103,000

AL at Dec. 31, 2018 (death benefit) = $2\% \times \$103,000 \times 15 \times 13.3 \times (1.05)^{-(65-62)} = \$355,011$