

# GH FVA Model Solutions

## Fall 2020

### 1. Learning Objectives:

1. The candidate will understand and apply valuation principles for insurance contracts.

### Learning Outcomes:

- (1a) Describe the types of claim reserves (e.g., due and unpaid, ICOS, IBNR, LAE, PVANYD).
- (1b) Explain the limitations and biases of the traditional valuation methods.
- (1d) Reflect environmental factors in reserve calculations (trend, seasonality, claims processing changes, etc.).

### Sources:

Skwire Chapter 37

### Commentary on Question:

*The Question was testing the basis for short-term benefit reserves. The key to the question was identifying the information from the syllabus and applying the knowledge to parts (b) and (c).*

### Solution:

- (a) Describe considerations for establishing claim reserves for short-term benefits.
  - Company's **internal practices**, which may cause lags to be faster or slower than normal which can be significant.
  - Consider **External environmental influences**, such as epidemics, governmental mandates or new laws
  - The types of benefits, utilization incentives or disincentives, claim sizes in general, and other **policy provisions**
  - **Insurance characteristics** such as new insured difference in utilization or a complicated new benefit.
  - Consider each **homogenous category of business**. The drawback of increasing the number or **reserve cells** is that the estimation error may be increased for cells that are too small (credibility of data for each cell)
  - **Managed care** initiatives or discounts including changes in utilization levels and impacts on larger sized claims.
  - Claims may increase or decrease significantly at various times of the year (**seasonality**).

## 1. Continued

- Recessions (**economic conditions**) will affect claims for elective treatments, but cause an increase in incidences and durations of claim where people fear the loss of coverage
- Reserve bases, reconciliation, trends and claims administrative expense factors are also important

(b) Describe ways you can check the reasonability of your claim reserve calculation.

- Reserve comply with ASOPs?
- Does the final amount make sense?
- How does it compare with the prior year?
- How does it compare to the industry?

(c) Explain the effects this change could have on your client's year-end claim reserves.

- Higher deductible plans have greater seasonality differences causing later quarter claim liabilities to be higher than earlier quarters. This could make their year-end liability greater despite the reduction in benefit.
- A new plan will likely impact utilization in the first year as employees get used to the new plan design.
- An announcement of a plan reduction could lead to increased utilization in the prior year in the form of a benefit rush.
- Changes in service mix (inpatient, outpatient, professional, drug)

(d)

(i) List and describe four stochastic modeling techniques.

(ii) List considerations for applying stochastic modeling to estimating reserves.

(i)

Monte Carlo Sampling and Simulation: Significant practical value when trying to combine results from any of the other stochastic models

Parametric Distribution –Works best when the process being modeled is stationary over time

Ordinary Least Squares Regression: Used when we want to investigate the effects of specific explanatory variables, such as time or seasonality.

Generalized Linear Models: Best to use when a dependent variable is either bounded or not normally distributed

Stochastic Time Series: Useful for handling situation where values are correlated across time

# 1. Continued

(ii)

- Availability of data
- Appropriateness of data
- Access to statistical software
- Validation of results
- Covariance between model inputs
- Advantages vs. disadvantages

## 2. Learning Objectives:

1. The candidate will understand and apply valuation principles for insurance contracts.

### Learning Outcomes:

- (1c) Calculate appropriate claim reserves given data.
- (1e) Evaluate data resources and appropriateness for calculating reserves.
- (1g) Apply applicable standards of practice related to reserving.

### Sources:

Group Insurance Chapter 38  
ASOP38  
Stahl (LTC News)

### Commentary on Question:

Group Insurance Chapter 38  
ASOP38  
Stahl (LTC News)

### Solution:

- (a) Describe data sources and considerations for creating an LTC claim continuance table.

#### Commentary on Question:

*Most candidates did well identifying both sources and considerations. Points were given for reasonable alternative answers.*

- Different tables may be used for different purposes – reserve basis, experience analysis, management reporting
- Continuance table probabilities may vary by factors such as gender, age, and benefit period
- May be based on published industry data. Consider whether industry data is applicable to your own block.
- SOA published Wilkins tables for nursing homes based on national survey
- SOA publishes periodic reports of experience based on private LTC plan experience
- Experience for specific companies varies widely from population studies
- NAIC has not specified a table for stat use
- Claim termination rates for most companies decline over time
- Most LTC insurers use their own experience if credible. Consider whether your company's experience is credible.
- Regularly should compare actual experience to assumptions

## 2. Continued

- (b) Describe potential concerns regarding your use of this data.

**Commentary on Question:**

*In general, the question was answered well. Minimal points were awarded if there was no reasonable justification connecting it to the situation.*

- Need to make sure definitions are consistent with source of termination assumptions. [Information about dates of loss (incurred dates), dates of service and paid dates is known accurately when the actuaries derive the continuance tables, but not when they apply those continuance tables. Benefit administrators are not usually able to accurately identify all the information for an open claim file.]
- Terminations due to death may be inappropriately affected by timing of searching for deaths. [Sometimes administrators try to help by attempting to be as up to date as possible with the claim status. They may unintentionally create a stronger bias, as the information may be easier to update on certain classes of people. For example, it may be easier to close a claim for death or recovery than to update a surviving claimant's actual service dates and expenses.]
- Other terminations may be inappropriately affected by timing of recertification. [Another example of a bias-generating practice is when administrators close claims upon hearing that a claim has terminated (either by death or recovery), without waiting for the last set of expenses to be submitted.]

- (c) Describe your ASOP 23 responsibilities regarding the review of data.

**Commentary on Question:**

*In general, candidates had a good understanding of ASOP 23. However, candidates frequently listed the responsibilities when selecting data from ASOP 23 and not the responsibilities when reviewing data.*

- The actuary should perform a review, unless, in the actuary's professional judgment, such review is not necessary or not practical.
- If no review is performed, the actuary should disclose this, the reason, and any limitation on the use of the actuarial work product.
- If no review is performed, the actuary should disclose this, the reason, and any limitation on the use of the actuarial work product.
- A reasonable effort to identify data values that are questionable or relationships that are significantly inconsistent.
- Consider comparing current with prior data for consistency.

## 2. Continued

- (d) Calculate the claim reserve at 12/31/2020 after the first benefit payment. Show your work.

**Commentary on Question:**

*Candidates generally struggled on this question. A common mistake was using 60% as the probability of remaining eligible for benefits for the second and third year. Some candidates confused the claim reserve per original policy with the claim reserve per in-force policy.*

Claims reserve per ORIGINAL policy at time 0

Present Value of Future Payments =

$$V_o(0) = B(1) * c(0,1) * v + B(2) * c(0,2) * v^2 + B(3) * c(0,3) * v^3$$

where  $B(t)$  is the benefit payable at time  $t$ ,  $c(s, t)$  is the probability of remaining eligible for benefits from time  $s$  to time  $t$ , and  $v = 1 / (1 + i)$   $i$  is the assumed interest rate.

Claims reserve per IN-FORCE policy at time 1 (based on initial assumptions)

Present Value of Future Payments =

$$V_i(1) = B(2) * c(1,2) * v + B(3) * c(1,3) * v^2$$

Claims reserve per ORIGINAL policy at time 1 (based on initial assumptions)

Present Value of Future Payments =

$$V_o(1) = V_i(1) * c(0,1)$$

Formula for relationship between time 0 and time 1

$$V_o(0) = B(1) * c(0,1) * v + V_o(1) * v$$

Solve for  $V_o(1)$

Time 0 reserve	\$ 10,043,736	
n	100	number of policyholders at time 0
i	3%	
v	0.971	
$V_o(0)$	\$ 100,437	
$B(1)$	\$ 103,000	
$c(0,1)$	60%	
$V_o(1) = V_o(0) / v - B(1) * c(0,1)$		
$V_o(1) =$	\$ 41,650	
Time 1 reserve	\$ 4,165,048.08	based on original 100 policies, and $c(0,1) = 60%$

Adjust for actual persistency		
Actual experience differed from the assumption - only 50 policyholders remained eligible after 1 year.		
Expected time 1 eligible policyholders	60	
Actual time 1 eligible policyholders	50	
Adjusted time 1 reserve	$4,165,048/60*50$ =\$3,470,873	

Or equivalently, solve for  $V_i(1)$

$V_i(1) = V_o(0) / c(0,1)$	
$V_i(1) =$	\$ 69,417
Adjusted time 1 reserve	$69,417 * 50 = \$3,470,873$

### 3. Learning Objectives:

1. The candidate will understand and apply valuation principles for insurance contracts.

#### Learning Outcomes:

- (1c) Calculate appropriate claim reserves given data.
- (1e) Evaluate data resources and appropriateness for calculating reserves.

#### Sources:

GHFV-103-16 Health Reserves (John Lloyd)

#### Commentary on Question:

*In general, the question was testing a candidate's comprehensive knowledge of the development reserving method. The question was divided into three sections where candidates were asked to demonstrate the following:*

*#3a – Successful candidates were able to provide the correct characteristics for which the development method was appropriate and describe why the characteristic was appropriate. Full points were awarded when candidates provided the characteristic and description.*

*#3b – Successful candidates were able to provide a clear recommendation and provide at least 2 supporting arguments for their recommendation. It was important for candidates not to contradict their arguments.*

*#3c – Successful candidates were able to use the data provided and calculate the completion factors which were then used to calculate the total year end reserves. If an error was made in the first part of the problem, we did our best to follow the error through the entire problem*

#### Solution:

- (a) Describe characteristics of coverage for which the development method is appropriate.

#### Commentary on Question:

*Key words have been highlighted in bold along with the description.*

1. Ability to systematically **record an incurred date and a payment date** as each claim is adjudicated and paid. The difference between these dates across policies in a valuation cell defines the lag pattern.
2. Fairly **consistent lag patterns** in the progression of claims from their incurred date to a date on which they are ultimately paid in full. Methods exist to smooth and adjust patterns for some disruptions, but the inherent payment pattern cannot be too erratic.



### 3. Continued

3. Incurred periods should have a **relatively short duration** relative to the ultimate run-out. Monthly periods typically are used for medical claims. Quarterly periods are often used for disability and may even work for large blocks of term life coverage. Annual periods are usually limited to some property/casualty coverages in which run-out may last for years. Longer incurral periods also create complications due to the impact of inflationary or operational changes.
  4. A **sufficient volume of business** must be included in a given valuation cell to obtain reasonable stable results. This amount varies by the nature of the benefits and the frequency of claim. Combining blocks of business to achieve credibility therefore requires that they exhibit similar patterns in reporting and processing.
  5. The technique also requires either **earned premiums or an exposed contract count** to assist in the calculations. These values help with certain volume adjustments and with the smoothing of statistical fluctuations described in more detail below.
- (b) Recommend whether or not the development method is appropriate for each company. Justify your answer.

**Commentary on Question:**

*It was very important for successful candidates to provide support for their recommendation and not to contradict their arguments. Successful candidates completed some analysis in Excel to help determine the best recommendation.*

*Candidates were able to provide either a positive or negative recommendation for Stagecoach Healthcare, LLC as long as their arguments stayed true to the recommendation. This was likely the most challenging company to make this determination as either could be justified.*

**Skyline Health:** No, the development method is not appropriate. The lag patterns are not consistent in the progression of claims from incurred date to ultimate date. The claim pattern can be considered to be too erratic to use the development method.

**Canyon Inc.:** Yes, the development method is appropriate. The lag patterns appear to be consistent with smaller amounts of paid claims in later lag periods. The duration appears to be within a 1-year timespan which is considered a shorter duration. Claim levels indicate that this is a large enough block of business to deem credible.

### 3. Continued

#### Stagecoach Healthcare, LLC:

- No, the development method is not appropriate. It is not clear when the ultimate date will be or what the ultimate claims amount will be in order to calculate the completion factors to be used in the development method

**Or**

- Yes, the development method is appropriate. The lag patterns appear to be consistent with smaller amounts of paid claims in later lag periods.

(c)

- (i) Calculate the completion factor for each lag using January's completion pattern. Show your work.
- (ii) Calculate the total year-end reserve using the completion factors developed in part (i). Show your work.

#### Commentary on Question:

*Successful candidates were able to use the given data and ultimately calculate the year-end reserve. In general, the parts of the question walk the successful candidate through the high-level steps to get the correct solution.*

*Calculate January cumulative claims for each lag – 1 point*

*Calculate completion factors – 1 point*

Lag 0 cumulative claims = \$2,000

Lag 1 cumulative claims = \$2,000 + \$2,900 = \$4,900

Lag 2 cumulative claims = \$4,900 + \$1,100 = \$6,000

Etc.

Lag	January Cumulative Claims
0	\$2,000
1	\$4,900
2	\$6,000
3	\$6,700
4	\$6,830

5	\$6,900
6	\$6,940
7	\$6,970
8	\$6,990
9	\$7,020
10	\$7,025
11	-

Lag 0 CF = \$2,000 / \$7,025 = 28.5%

Lag 1 CF = \$4,900 / \$7,025 = 69.8%

Lag 2 CF = \$6,000 / \$7,025 = 85.4%

Etc.

Lag	CF
0	28.5%
1	69.8%
2	85.4%
3	95.4%
4	97.2%
5	98.2%
6	98.8%
7	99.2%
8	99.5%
9	99.9%
10	100.0%

Ultimate Claims = Cumulative Claims / CF

Cumulative Claims are given in the chart

December ultimate claims = \$1,800 / 28.5% = \$6,323

November ultimate claims = \$4,300 / 69.8% = \$6,165

October ultimate claims = \$7,200 / 85.4% = \$8,430

Etc.

Reserve = Ultimate Claims – Cumulative Claims

December reserve = \$6,323 - \$1,800 = \$4,523

November reserve = \$6,165 - \$4,300 = \$1,865

October reserve = \$8,430 - \$7,200 = \$1,230

Etc.

The total year-end reserve should be set at \$8,529,000.

### 3. Continued

Month	Lag	CF	Cumulative		Reserve
			Claims	Ultimate Claims	
January	11	100.0%	\$7,025	\$7,025	\$0
February	10	100.0%	\$8,026	\$8,026	\$0
March	9	99.9%	\$8,220	\$8,226	\$6
April	8	99.5%	\$7,320	\$7,357	\$37
May	7	99.2%	\$7,510	\$7,569	\$59
June	6	98.8%	\$7,430	\$7,521	\$91
July	5	98.2%	\$7,480	\$7,616	\$136
August	4	97.2%	\$7,530	\$7,745	\$215
September	3	95.4%	\$7,600	\$7,969	\$369
October	2	85.4%	\$7,200	\$8,430	\$1,230
November	1	69.8%	\$4,300	\$6,165	\$1,865
December	0	28.5%	\$1,800	\$6,323	\$4,523
				<b>Total Reserve</b>	
				(000's)	<b>\$8,529</b>

#### 4. Learning Objectives:

2. The candidate will understand an actuarial appraisal.

#### Learning Outcomes:

- (2d) Differentiate traditional, European, and market-consistent embedded value.

#### Sources:

Embedded Value: Practice and Theory

GHFV-133-19 – Simple embedded value sample

#### Commentary on Question:

*This question tests the candidate's knowledge of the similarities differences between European Embedded Value and Market-Consistent Embedded Value as well as the calculations required to determine Embedded Value for a simple insurance product.*

#### Solution:

- (a) Compare and contrast European embedded value and market-consistent embedded value.

#### Commentary on Question:

*Candidates generally remembered that MCEV uses market-consistent assumptions while EEV uses best-estimate assumptions, though some candidates confused the two. Some missed that the EVs measure **shareholder** ownership value.*

- EEV and MCEV are both measurements of the value that shareholders own in an insurance enterprise.
  - MCEV brings EEV into a risk-neutral, market-consistent setting.
  - MCEV results in a measurement basis that is more consistent with the fair value basis.
  - MCEV improves consistency of measurement across companies by removing most of the subjectivity previously reflected in a company's financial assumptions.
  - Under MCEV, investment returns are assumed to equal the risk-free rate, whereas under EEV, investment returns are set to best estimate return
  - The analysis of movement of MCEV can be significantly more complicated than for EV, because it effectively involves tracking the movement of the fair values of both assets and liabilities.
- (b) Calculate the embedded value of the group dental block of business at time 0 using the information provided above. Show your work.

#### Commentary on Question:

*Many candidates double counted the policy lapses by setting up a column of cumulative lapses as well as a recursive formula that refers to the prior year's total premium. E.g.*

#### 4. Continued

*Year 0 Premium = \$15,000,000*

*Year 1 Premium = \$15,000,000 \* 0.92 = \$14,628,000*

*Year 2 Premium = \$14,628,000 \* 0.8464 : Should be \$14,628,000 \* 0.92 or \$15,000,000 \* 0.8464*

*Some candidates also neglected to include the statistical fluctuation factor in calculating the MCCR.*

Year	End of Year			Post-tax target profit	Post-tax interest on capital	Capital cashflow	Discount factors
	Premium	MCCR	Capital				
0	\$15,000,000	\$1,350,000	\$2,025,000				1.000
1	\$14,628,000	\$1,316,520	\$1,974,780	\$271,350	\$52,650	\$102,870	0.909
2	\$14,265,226	\$1,283,870	\$1,925,805	\$264,621	\$51,344	\$100,319	0.826
3	\$13,911,448	\$1,252,030	\$1,878,045	\$258,058	\$50,071	\$97,831	0.751
4	\$13,566,444	\$1,220,980	\$1,831,470	\$251,658	\$48,829	\$95,405	0.683
5	\$13,229,996	\$1,190,700	\$1,786,049	\$245,417	\$47,618	\$93,039	0.621
6	\$12,901,892	\$1,161,170	\$1,741,755	\$239,331	\$46,437	\$90,731	0.564
7	\$12,581,925	\$1,132,373	\$1,698,560	\$233,395	\$45,286	\$88,481	0.513
8	\$12,269,894	\$1,104,290	\$1,656,436	\$227,607	\$44,163	\$86,287	0.467
9	\$11,965,600	\$1,076,904	\$1,615,356	\$221,962	\$43,067	\$84,147	0.424
10	\$0	\$0	\$0	\$216,458	\$41,999	\$1,657,355	0.386
			Present value	\$1,522,162	\$295,345	\$1,184,403	

A. Discounted capital cash flow at end of year 0	\$1,184,403
B. Capital at end of year 0	\$2,025,000
C. Cost of capital (A-B)	(\$840,597)
D. Discounted post-tax profits	\$1,522,162
E. Embedded value (C + D)	\$681,565

## 5. Learning Objectives:

1. The candidate will understand and apply valuation principles for insurance contracts.

### Learning Outcomes:

- (1f) Describe, calculate and evaluate non-claim reserves and explain when each is required
- (1g) Apply applicable standards of practice related to reserving.

### Sources:

AAA Premium Deficiency Reserves Discussion Reports

ASOP 42

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

- (a)
  - (i) Compare and contrast the purpose of premium deficiency reserves (PDRs) for statutory accounting and for Generally Accepted Accounting Principles (GAAP) accounting.
  - (ii) Explain how PDRs may impact statutory and GAAP accounting differently.

### Commentary on Question:

*Generally, candidates did better on part i. For part ii, candidates got points for explaining impacts on the balance sheet and income statement.*

- (i) For both Stat and GAAP, the PDR establishes a reserve for projected future shortfall that has been contractually assumed.  
For Stat, the PDR helps identify a risk of insolvency.  
For GAAP, assuming the entity will continue as a going concern, the PDR helps more accurately assess the current and future value of the operations.
- (ii) Stat is focused on current insolvency risk rather than future results, so recognizing future losses on only a portion of the entity's business via a PDR could be misleading (because corresponding future gains on other business aren't reflected).  
GAAP is more focused on expected future results, so PDRs are less misleading. They reduce current profitability, but improve the representation of future earnings. They remove noise from the recognition of future earnings (as the PDR is released).

## 5. Continued

The balance sheet impact of a PDR in GAAP may be less significant than in Stat.

- For example, there is no GAAP equivalent of RBC (risk-based capital) impacted by including a PDR.
- However, a PDR in GAAP could negatively impact debt covenants or other contractual commitments

And, applying a PDR in GAAP could fail to meet shareholder expectations for the current financial results.

- (b) Calculate the total net gain/loss for 2020 using the above information. Show your work.

### Commentary on Question:

*Candidates were given full marks if they applied the correct grouping by line of business, calculated the correct PDR per group and in total, and calculated the correct net result including the change in PDR. A common mistake was incorrect or no grouping.*

HRGM Grouping	2020	2021	2022	PDR
Comprehensive Major Medical				
Group Dental	3	2	2	
Group Major Medical	1	1	1	
<u>Individual Major Medical</u>	<u>-4</u>	<u>-2</u>	<u>1</u>	
Comprehensive Major Medical	0	1	4	0
Income Protection Insurance				
Group Long-term Disability	2	3	4	
<u>Group Short-term Disability</u>	<u>-5</u>	<u>-4</u>	<u>-3</u>	-
Income Protection Insurance	-3	-1	1	4
Limited Benefit Plans				
<u>Individual Critical Illness</u>	<u>-1</u>	<u>-1</u>	<u>1</u>	
Limited Benefit Plans	-1	-1	1	2
Total PDR at 2019-12-31				6



## 5. Continued

2020 Results Before PDR = Earned	
Premium – Incurred Claims – Expenses =	
50-42-10=-2	
Total PDR at 2019-12-31	6
<u>Total PDR at 2020-12-31 (Given)</u>	<u>3</u>
Change in PDR	-3
Net Gain/Loss for 2020 = -2 – (-3)=	1

- (c) List and describe ASOP 42 considerations for estimating premium deficiency reserves.

### **Commentary on Question:**

*To earn full marks, the candidate needed to give some meaningful description of the consideration – a list of items was not sufficient.*

**Blocks of Business** - The actuary should consider blocks of business in a manner consistent with applicable financial reporting requirements.

**Time Period** - The actuary should use the valuation date as the beginning of the time period used to project losses from a block of business.

**Exposure** - The actuary should consider reasonable increases and decreases in exposure units over the time period

**Premium Rate Changes** - When using a premium rate change assumption, the actuary should use an assumption that is reasonable in relation to the projected claims costs and the risk-bearing entity's expectations.

**Claim Trend** - The actuary should consider factors that may materially affect future claim payments

**Risk-Sharing Arrangements/Provider Arrangements** - The actuary should consider risk-sharing arrangements between the risk-bearing entity and other entities

**Interest Rates** - When using an interest rate assumption to reflect the time value of money in a present value calculation, the actuary should consider items such as the projection period

**Reinsurance** - The actuary should consider the expected effects of reinsurance

**Taxes** - The actuary should consider the effect of losses assumed in the calculation of the premium deficiency reserve on the risk-bearing entity's taxes

## **5. Continued**

Non-Claim Expenses - The actuary should consider total expenses of the risk bearing entity in estimating a premium deficiency reserve and should consider whether the expenses allocated to the block of business are reasonable

Applicable Authority - The actuary should consider any applicable law, regulation, or other binding authority

## 6. Learning Objectives:

1. The candidate will understand and apply valuation principles for insurance contracts.

### Learning Outcomes:

- (1c) Calculate appropriate claim reserves given data.
- (1e) Evaluate data resources and appropriateness for calculating reserves.
- (1g) Apply applicable standards of practice related to reserving.

### Sources:

Bluhm – Individual Health Insurance 2nd Ed Ch 6

ASOP 22: Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

- (a)
  - (i) Define cash flow testing.
  - (ii) List the six risks identified by the National Association of Insurance Commissioners (NAIC) as being important to cash flow testing.

### Commentary on Question:

*Most candidates had a general understanding of cash flow testing and provided a limited definition that allowed for partial credit. Only a few candidates were able to list all the risks identified by the NAIC as being important to cash flow testing. Although many candidates accurately identified morbidity, mortality and lapse, and were able to achieve partial credit.*

- (i) Cash Flow Testing **looks at both the assets and liability** over a set period of time. Cash Flow testing is a way to evaluate **the risk associated with the timing or amount of cash flows**
- (ii)
  - Morbidity
  - Mortality
  - Lapse
  - Asset credit quality
  - Reinvestment
  - Disintermediation

## 6. Continued

- (b) Describe asset adequacy analysis testing methods, other than cash flow testing, that you can apply.

**Commentary on Question:**

*Many candidates were able to fully list and describe the alternate asset adequacy analysis testing methods. Candidates typically were able to either achieve full credit on this part, or none at all.*

Gross Premium Reserve Test

The actuary can demonstrate that the degree of conservatism in the reserves and other liabilities is so great that moderately adverse deviations in the actuarial assumptions are covered

The actuary can demonstrate that the product designs and/or investment strategies limit moderately adverse experience from happening.

Loss Ratio Method

- (c) Evaluate whether a gross premium reserve is necessary. Show your work and justify your answer.

**Commentary on Question:**

*This question was testing whether candidates knew the gross premium reserve (GPR) formula and could justify whether a GRP was required. Most candidates did not calculate the GPR correctly, but came to the correct conclusion that a GPR was not necessary. One of the more common errors was that candidates calculated +\$69M instead of -\$69M. Some candidates ignored the current statutory reserves in their calculations, but considered it in their justification for whether a GPR was necessary. Candidates received partial credit in these situations.*

GPR = PV of Benefits & Expenses minus Current Reserve and Future Revenue  
(69,000,000)

GPR is negative so no GPR needed

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- (d) Calculate the projected value of the deferred acquisition cost (DAC) asset per original policy after 3 years, immediately prior to recognition of the premium payment. Show your work.

## 6. Continued

### Commentary on Question:

*This question was testing candidates understanding of DAC assets and their ability to calculate its value at a particular point in time. Most candidates had difficulty with this question and were unable to provide all the components necessary to achieve full credit. Many candidates correctly calculated the persistency and discount factors, and some were able to calculate the net level expense premium. A handful of candidates calculated the reserve on a "per surviving policy" basis, and a portion of these were adjusted to a "per original policy" basis. To receive full credit candidates need to show all the calculations and explain the steps.*

-The cost of selling, underwriting, and issuing the policy is deferrable as a DAC asset.

-DAC Formula= AV(deferrable Expenses)- AV(Net Expense Premium)

-Calculate sumproduct of persistency and discount

Time t	Persistency	Discount	P * D
0	1.000	1.000	1.000
1	0.920	0.971	0.893
2	0.846	0.943	0.798
3	0.779	0.915	0.713
4	0.716	0.888	0.637
			4.040

-Divide deferrable expenses by the sumproduct to get the net level expense premium. This is per year for 5 years and has present value equivalent to the deferrable expenses. 247.52

-After 3 years, immediately prior to recognition of the premium payment, there are 2 remaining net level expense premium amounts.

Calculate PV of the remaining net level expense premium amounts and sum them together - this is the prospective reserve "per surviving policy". 468.60

Convert to "per original policy" - this is the DAC asset at t=3 just prior to recognition of premium 364.89

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## 7. Learning Objectives:

2. The candidate will understand an actuarial appraisal.

### Learning Outcomes:

- (2e) Describe the actuarial due diligence process.

### Sources:

Toole & Herget, Chapter 5 of Insurance Industry Mergers & Acquisitions

### Commentary on Question:

*Open ended question with many possible responses, some candidates have a hard time to come up with a good list of questions covering sufficient range of aspects for due diligence and there were widespread confusions regarding connections referred to in part b (ii)*

*More than a few candidates weren't able to locate the case study.*

### Solution:

- (a) List and describe five major objectives of due diligence.

### Commentary on Question:

*Pretty straight forward here, but many candidates only provided the list with minimal or no descriptions.*

- **Confirm strategic value** – should get additional value beyond the strict financial value of the acquired business such as
  - Increased market share
  - Complementary markets, products or distribution
  - Exploitation or leveraging of superior technology
  - Increase in scale and ability to leverage existing resources better
  - Preventing a new entrant to the market
- **Confirm financial value** –
  - start with the seller's actuarial appraisal which is modified based on the market value of the target and the actual and projected financial performance.
  - Establish there are no "holes" in the seller's financials
  - Develop the assumptions needed to support financial calculations.
- **Confirm operation value** – Identify whether there are any weaknesses in the seller's operational areas. If weaknesses exist, determine how to fix the issues and quantify any financial impact while fixing those weaknesses. Determine how effectively the acquired operation can be integrated into the buyer's operation.
- **Construct appropriate bid** –
  - needs to be high enough to recognize value, but also generate sufficient returns for the buyer.
  - Consider any issues identified during due diligence

## 7. Continued

- **Prepare for successful integration** – plan specific steps to protect or improve value. These will occur when the public announcement of the deal is made, some pre-closing and some post-closing.

(b)

- (i) Propose twelve questions to focus on during due diligence.
- (ii) Identify the connection of each question in (i) to specific information in the case study.

### **Commentary on Question:**

*Some candidates only focused on a few aspects of due diligence.*

*Majority of the candidates failed to identify the connections between the questions and the merger parties involved.*

Areas to be covered in the questions:

Financial

Investment

Tax

Legal & Compliance

Marketing & Distribution

Systems

Personnel, compensation & benefits

Product management

Claim management

Reinsurance

Risk management

Actuarial – Life & Health

Review of financials

Review of operations (incl ERM)

Development of buyer's appraisal & PGAAP pro formas

Support of bid development & negotiations

Preparation for closing and integration

Sample questions with connections:

Q. What is the status of the due diligence process, and plan for timeline and steps?

C. **R & P have had “preliminary discussions”.**

Q. Can we confirm the strategic value of P to R?

C. **Per the case study, this includes new product markets and sharing product expertise.**

## 7. Continued

Q. Will sharing product expertise actually benefit the companies as expected?

C. **The lines of business of P are fairly dissimilar to R's - supplemental health is the closest, but still supplemental health in Canada is very different and more limited than US health coverage.**

Q. Can we confirm the financial statements of P?

C. **Financial statements are provided in the case study. We need to verify the balance sheet value of assets, sufficiency of reserves, etc.**

Q. What effect will the financial performance of P have on R?

C. **This will impact R's financial statements in earnings, capital, etc.**

Q. Does the data (revenue, income, etc) in P's financial statements support the assumptions used in the actuarial appraisal?

C. **This will be based on the review of the case study financial statements and the appraisal.**

Q. Is the business culture of P consistent with R's?

C. **Per the case study they have a "similar corporate vision" and "strong reputation".**

Q. How will operations be integrated?

C. **The companies are very different – R is in US health while P is in several lines in Canada – so operations may not be very similar.**

Q. How will the resultant company be structured? How will the management and organization of R and P be balanced?

C. **Based on 2019 revenue, R's revenue is more than 3 times P's, but R's net income is smaller. P & R will need to negotiate the new structure, management, etc.**

Q. What should the bid amount be?

C. **This is based on both the appraisal (based on the provided financials and other information) as well as many other qualitative considerations.**

Q. Will the bid be in cash, stock, or a combination?

C. **The number of outstanding shares of R is given in Email 2.**

Q. How will the companies be integrated?

C. **For example, P employs 2,000 people in Canada and is interested in expanding internationally, while R is focused on health insurance in the Midwest US.**

Q. Why has P's revenue dropped significantly in the past 3 years?

C. **Revenue drop is shown in income statement. This appears especially to be a drop in the Disability line premiums.**

Q. Why has P's net income dropped significantly in 2019?

C. **Net income drop is shown in the income statement. This appears to be due to the revenue drop.**

Q. Why have P's G&A expenses dropped in 2018 and 2019?

C. **G&A drop is shown on income statement. These are typically more fixed than commissions, and a drop may indicate cuts to the company.**



Q. Why did the “Investment in subsidiaries” balance sheet line increase by more than \$2M in 2019? What does this represent, and can we verify it?

C. **Shown on balance sheet.**

Q. Why was P’s investment income much lower in 2019 than in 2017-2018?

C. **Investment income is shown on the income statement.**

Q. How would the merger affect the tax positions of each company?

C. **R’s tax rate is given as 21%, and P’s tax rate can be calculated as 20% from the income statement.**

Q. How will regulation, licensing, and legal issues apply to the combined company?

C. **Per the case study, the companies have different home countries and lines of business. Therefore different regulation, licensing, and legal environments will apply.**

Q. Does P use reinsurance, and what is the nature of these contracts?

C. **Based on their assets/liability sheets, it appears that they are collecting some receivables but it’s not apparent if that’s from reinsurance. This should be looked into and the nature of these contracts should be evaluated to see if they’re from authorized reinsurers.**

Q. How does experience look like following the valuation date?

C. **Most of the prior emails focus on valuation up to the end of 2019 while R Email#3 gives some context into experience after the valuation date of December 2019 which is important to look at as it reflects any recent changes in experience.**

Q. Regarding the balance sheet, what is there a level of conservatism in the assumptions/ any deficiencies?

C. **This is shown in P’s balance sheet.**

Q. What are the IS systems that P and R utilizes?

C. **We can potentially consolidate these systems to have a reduced administrative expense ratio in the combined entity.**

Q. What are some potential issues in the balance sheets?

C. **P Diluted shares < Basic Shares for the NI per Share metric. This is mathematically impossible.**