

## Course Coverage

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Question	Units	Syllabus Performance Outcome	Total Marks
1 (a)	1	1.2	3
1 (b)	1	1.2	25
1 (c)	1	1.2	2
2 (a)	1	2.3	6
2 (b)	2, 3	4.2, 6.1	9
2 (c)	4	8.4	8
2 (d)	4	9.1	7
<b>TOTAL</b>			<b>60</b>

## Answer 2 questions

**QUESTION 1**
**(30 Marks)**

You are the Valuation Actuary at Nadal Life. Nadal Life specialises in writing group insurance policies covering Death and Total and Permanent Disability benefits. The company has been writing this business since 2010. In addition to these policies, it has a separate book of legacy participating business.

For the 31 December 2013 valuation, the IBNR for the business has been determined based on an assumed ultimate undiscounted loss ratio of 92%, which is consistent with that used for pricing. The table below shows the earned premiums and claims reported to Nadal Life since the inception of Nadal Life's group business.

Incidence year	Earned premiums (\$000s)	Claims Reported	
		Claims Paid	Claims Pending
2010	110,000	99,004	3,425
2011	110,000	99,458	9,189
2012	110,000	95,297	13,098
2013	200,000	168,499	34,192

A new three year premium guarantee period began in 2013 and this coincided with a 60% increase in sum insured but also a change in TPD definition that was designed to tighten the requirements that need to be met for a TPD claim to be accepted.

- a) Calculate the IBNR for Nadal Life using this approach. Note that Nadal Life's accounting policy assumes that pending claims are shown on the balance sheet at 85% of their reported value to allow for the expected rate of declinature of claims. Comment on the appropriateness of the valuation methodology used and when such an approach may be appropriate (ignore discounting in your calculation). **(3 Marks)**

- b) You are exploring the option of applying a more sophisticated technique to determine the IBNR. You have been able to obtain and collate historical claims data for all of the Group schemes insured by Nadal Life (including claims data for the period prior to Nadal Life becoming the insurer).

This data provides information on the following for each of the claims:

- Date that the claim was reported to the insurer (in the case of pre-2010 claims, this was the date of reporting to the previous insurers Golden Life and Silver Life);
- Date that the claim was incurred;
- The status of the claim being either:
  - Paid – i.e. claim was accepted and paid;
  - Pending – i.e. claim is under assessment with the claim amount being the full claim amount; or
  - Declined - i.e. declined without payment.

The claims data is in the spreadsheet in the "Claims Data" sheet.

Your analyst has calculated the IBNR based on a chain ladder methodology and using a discount rate of 4%. She has calculated two IBNR estimates, one based on claim amounts and the other on claim numbers (multiplied by an average claim size). Her calculations are contained in the sheet named "IBNR Analysis – Analyst".

As the Actuary for Nadal Life, you are responsible for the final IBNR. Review the data and approach used by the analyst in calculating the IBNR reserve for Nadal Life under both approaches. As a result of this review, prepare a valuation note for the valuation files including:

- (i) List the data checks that you carried out; (2 Marks)
- (ii) Any issues identified in the claims data and related adjustments made; (15 Marks)
- (iii) Any assumptions used in the determination of the IBNR, comments on their suitability and whether any changes are required; (5 Marks)
- (iv) Your estimate of the final IBNR for Nadal Life. (3 Marks)

To assist you in the calculation of the IBNR, the attached spreadsheet includes a sheet named "IBNR Analysis – Actuary" which can be modified. This spreadsheet links to columns N to R in the "Claims Data" sheet, which can also be modified for the purposes of making any adjustments.

(You can assume for the purpose of this question that the discount rate chosen is appropriate). (25 Marks)

- c) Noting the experience of the business and the fact that the current premium guarantee period still has two years to run, your CFO asks if any additional reserves would be required to be held for this business other than those relating to past periods of exposure. He notes that the participating business has significant margins and these could be used to cover any deficiency. Set out the points you would make to the CFO to cover his question. (2 Marks)

**SOLUTIONS: QUESTION 1**

a)

The table below shows the calculation of the IBNR under the current methodology:

Incidence year	Earned premiums (\$000s)	Claims Reported		>>> <b>Calculation</b>		
		Claims Paid	Claims Pending	Total Claims (after pending factor applied)	Expected Claims (92% loss ratio)	Undiscounted IBNR (\$000s)
2010	110,000	99,004	3,425	101,915	101,200	-715
2011	110,000	99,458	9,189	107,269	101,200	-6,069
2012	110,000	95,297	13,098	106,430	101,200	-5,230
2013	200,000	168,499	34,192	197,562	184,000	-13,562
				<b>IBNR using current methodology</b>		<b>-25,576</b>

Comments on the appropriateness should include:

- The IBNR is not appropriate since it is negative (a sign that the claims reported to date have already exceeded the 92% loss ratio in each of the year's that Nadal Life has had this business)
- The approach may be suitable for a portfolio in its early stages of development or for those recent exposure periods where development is small. However, in this case a 92% loss ratio is clearly too low for the 2013 period also.
- The approach may be suitable for a fairly homogenous and stable book of business both in terms of product type and characteristics within the book. However, any change in the mix of TPD vs death benefits will impact the reasonableness of the assumption significantly due to the different respective claim patterns.

**Marking Guide:**

- **1 mark for correct calculation of the IBNR**
  - **1 mark for noting that the method is not appropriate and giving reasons why**
  - **1 mark for noting the method may be appropriate for a portfolio in an early development stage**
  - **0.5 marks for nothing it may be appropriate if the benefit mix is stable**
- To a maximum of 3 marks.**

b)

To: Valuation File

From: Valuation Actuary

RE: Group IBNR Calculation at 31 December 2013

i) Data Checks Completed During the Review

- Existence of duplicate policies.
- Policyholder's dates of birth were reasonable (e.g. all policyholders were between 18 and 70).
- Existence of excessively large/small claims compared to others.

- Declined claims were excluded.
- Pending claims were only allowed for at 85% of their value.
- Policies were assigned to the correct half year for analysis.
- There were no miscellaneous entries in the data (e.g. blank cells, errors etc).
- All notification dates were after the claim incurred dates.
- All notification and incurred dates were before the valuation date.
- All assumptions used in the calculations were correct.

#### ii) Data Issues Identified and Adjustments Made

- Declined Claims

Declined claims are included in the analyst's claims data. The declined claims should be removed from the analysis.

- Pending Claims

Pending claims are included in the analyst's claims data. The pending claims should be shown at 85% of their actual value (in terms of claim count and by amount).

- Duplicate Claims

The claims notified in 2009 from "Silver Life" seem to have been duplicated with the same claims number and information for Nadal Life (which took over the business in 2010). The Nadal Life claims therefore seem to be incorrect duplicates and hence should be removed from the analysis.

- Normalising for large claims

There are 5 claims greater than \$1m totaling \$17m over the 8 year exposure period (an average of \$2.125m per annum). The main impact is due to two \$4m claims in the 2013 year (which is not very developed and hence the impact of these is magnified by the chain ladder). Only these two claims have been removed from the experience. The other large claims in the experience have not been removed on the basis that they are representative of the large claims experience expected in the claims development pattern.

- Claims with future notification dates

Some claims have notification dates in the future. These could relate to any year (likely mistyped into the claims system). An assumption that these claims were notified in 2013 seems reasonable (noting that the number of claims is small and hence do not materially impact the result).

#### iii) Assumptions Used in the Determination of the IBNR

- 2013 experience – Loss Ratio Approach

An assumption has been made that prior years experience is a good indicator of the claims run off for 2013. This is a normal assumption within IBNR valuations. However, there is poor experience in the early development period for 2013 which is leading to an estimate of very high future claims costs. This could be the result of acceleration in claims reporting

or of poor experience but it may also be the result of incorrect claims dates which are in the future. The estimated claims costs for H1 and H2 are above that given in the question indicating that it may be a data issue.

Given the limited development, using a loss ratio to value these 2 half years based on the average of the loss ratios since 2010 could be appropriate (i.e. 100%) however this may still underestimate the IBNR given the experience for claims incurred (allowing for pending claims) is already above 100%. This would mean not valuing these reserves under the run-off approach and holding a very small IBNR on the assumption that most claims have already been incurred and reported.

An alternative approach would be to use the claims development factors in the run-off approach and not make an adjustment. Instead, an investigation into the claims notifications dates could be conducted to try to improve the data set for future use. This is likely to be a conservative approach.

- Death/TPD mix

The analysis does not consider the claim run-off periods for the TPD and Death benefits separately. If they have different run-off profiles and the business mix changes then this is unlikely to be appropriate.

Consideration should be given to the amount of data on each and whether there is enough to build a credible analysis of each benefit separately. There also appears to be sufficient data on each benefit with c.1,600 Death claims and c.900 TPD claims spread over the analysis period.

In the case of Nadal Life, when the data is split different run-off profiles can be clearly seen giving weight to the view that using a combined approach is inappropriate and that there is enough data to complete a split. Death policies have a much shorter run-off profile on average than the TPD policies as shown in the table below.

Average Claim Amount Development Factors by half years

	0	0.5	1	1.5	2	2.5 +
TPD	2.24	1.62	1.30	1.07	1.04	1.06
Death	1.01	1.04	1.00	1.00	1.00	1.00

- Average Claim Size

The average claim size selected is based on an average of all years. There has been a step change in average claim size since 2010 and in 2013 onwards. Hence, an average claim size that is only based on more recent years would be a more appropriate assumption.

#### iv) Final IBNR

Based on all these adjustments and assumptions, I have calculated an IBNR for Nadal Life of approximately \$90m on a claims amount basis and approximately \$65m on a number of claims basis.

I recommend an IBNR of \$80m would be an appropriate IBNR for Nadal Life at 31 December 2013.

**Marking Guide:**

(i)

- 0.5 marks for each sensible data check listed (0.5 marks each)
- To a maximum of 2 marks

(ii)

The following relates to the data issues:

- 1 mark for identifying each of the data issues plus 1 mark for identifying an appropriate solution to rectify the issue (up to 10 marks)
  - 2 marks for correctly adjusting for each in the spreadsheet (to a maximum of 10 marks)
- To a maximum of 15 marks.

(iii)

- Noting the projected claims incurred during 2013 being high and the possible need to make an adjustment for it (1 mark)
  - Noting that the projection may be high for HY2 due to the incorrect dates for some notifications so it may not be necessary to correct methodology for it. (1 mark)
  - Suggesting a long term data solution to the dates e.g. investigation into each claim to determine more accurate dates (1 mark)
  - Making an appropriate adjustment to the IBNR by using an appropriate loss ratio (2 marks)
  - Noting that the loss ratio approach makes the IBNR seem unreasonably small (1 mark)
- To a maximum of 3 marks.

- Noting that Death and TPD Claims could be split and discussing the reason why (1 mark)
  - Discussion on the suitability of the data for a split analysis (1 mark)
  - Implementing an appropriate change to the analysis to consider a split (2 marks)
- To a maximum of 3 marks.

- Noting the issue with the average claim size chosen (1 mark)
  - Making an appropriate adjustment to the IBNR using an average claim size based only on the last few years (1 mark)
- To a maximum of 2 marks.

To a maximum of 5 marks for part (iii).

iv)

For the calculation of a reasonable IBNR estimate in total if no TPD or Death Split applied

- 2 marks if within the range (\$60m - \$100m); else
- 1 Mark if \$50m to \$60m or \$100m to \$110m; else
- 0.5 marks if \$40m to \$50m or \$110m to \$120m.

**For the calculation of a reasonable IBNR estimate in total if a TPD or Death Split applied**

- 2 marks if within the range (\$140m - \$230m); else
- 1 Mark if \$120m to \$40m or \$230m to \$250m; else
- 0.5 marks if \$100m to \$120m or \$250m to \$270m.

**1 mark for appropriate use of language and clearness of communication for all of part b.**

**To a maximum of 3 marks.**

c)

- During the guarantee period premiums cannot be raised to offset experience losses. A reserve needs to be held for the future losses until the end of the current guarantee period for the group business of Nadal Life.
- The margins from the participating business cannot be used to offset any group business losses.

**Marking Guide**

- 1 mark for each of the above points

**To a maximum of 2 marks.**



**QUESTION 2**

**(30 Marks)**

You are the Actuary at Clooney Life, an Australian life insurance company which is the subsidiary company of a North American insurer. Clooney Life writes both individual policies written through independent financial advisors and group business.

The individual business covers death and trauma. The group business covers death and TPD.

The group business is comprised of a number of small to medium sized schemes which have a premium guarantee period of 3 years (after which most schemes go to a market tender).

Your parent company reports on a US GAAP basis and hence Clooney Life will have to report on both a MoS basis (for its local accounts) and a US GAAP basis (for its parent office's consolidated accounts).

For Clooney Life, this US GAAP basis requires:

- For active lives, liabilities are to be valued based on the assumptions that were in place at the time each policy was written (including investment assumptions). These assumptions are determined based on each year's experience investigation as best estimate plus a Provision for Adverse Deterioration ("PAD") which is a margin added to the best estimate assumption;
  - The US GAAP reserves for active lives are comprised of a benefit reserve which is calculated on a net premium type of valuation approach and a separately calculated DAC which runs off based on premiums. The DAC is shown as an asset on the balance sheet;
  - For claims reserves (i.e. IBNR and Disabled Lives Reserves), liabilities are valued based on current best estimate assumptions;
  - Loss Recognition testing under US GAAP is undertaken at a global level where the Australian business will be combined with the other business in the Asia Pacific for this purpose (which is quite large and very profitable for the parent company); and
  - Assets are reported on the balance sheet at Book Value.
- a) The CFO of your parent company (the Group CFO) has asked you to provide some detail as to how reporting will differ between the MoS and US GAAP basis for each line of business. In particular, she has asked you to highlight the key differences and similarities in the MoS and US GAAP balance sheets.

Set out the points you would make to the Group CFO covering her questions.

**(6 Marks)**

- b) The reinsurance arrangements of Clooney Life are currently sitting with a large international reinsurer who has been designated as a "specialist reinsurer" by APRA. The Group CFO is annoyed that Clooney Life is passing off its profits to a third party when such business could be reinsured directly with the parent company.

The Group CFO has asked you to put together a short memo drafting the potential negative implications for Clooney Life for reinsuring within the group. For each of these implications, she would also like you to document some ideas on how these challenges could be overcome. Draft the requested memo to the Group CFO.

**(9 Marks)**

- c) Being a North American life insurer, the parent company is not particularly familiar with embedded value reporting. The Group CFO has asked you to calculate a traditional embedded value for Clooney Life.

For the purposes of the embedded value calculation, the parent company determines the assumptions to be used for the calculation. You are provided with the following information:

	2014 Expected Claims Ratio	2014 Expected Premium	2014 Expected Expenses*	2014 Expected Commission Rate	Economic Capital as a % premium
<b>Individual</b>	55%	\$200m	\$24m	20%	20%
<b>Group</b>	82%	\$160m	10%	4%	30%

\* Expenses expressed for group as a % of premium

<b>Additional Assumptions</b>	<b>Individual</b>	<b>Group</b>
Expense Indexation (pa)	2%	n/a
Lapse Rates (pa)	12%	n/a
Investment Income (pa)	3.5%	3.5%
Premium Rate Increase (pa)	10%	n/a
2014 Claim Rate (qx)	0.10%	n/a
Annual Claim Rate Increase	10%	0%
Risk Discount Rate	13%	

Use the information above to calculate the Value of Inforce Business (VIF) separately for group, and individual business. The parent company has provided a worksheet with the format of the cashflows that need to be populated for this purpose (the assumptions listed above are also provided on the front sheet).

Clearly identify any additional assumptions that you have made in the calculation of the VIF. (8 Marks)

- d) The Group CFO is very encouraged by the results of your analysis. She is however concerned that if she reports these results to the Board of the parent company they will be expecting this value of business to materialise.

She knows that the value is dependent on a number of actuarial assumptions but is not too sure which assumptions the model is most sensitive to.

She has asked you to prepare another report covering the following:

- Identification of three key assumptions which have a significant influence on the VIF;
- For each of these assumptions, propose a suitable stressed assumption and recalculate the VIF under the stress;
- For each of these assumptions, actions that Clooney Life could reasonably take to manage the risk that actual experience is worse than the assumptions.

Draft the report for the CFO.

(7 Marks)

**SOLUTIONS: QUESTION 2**

a)

Responses to the CFO's questions regarding the differences in US GAAP and MoS reporting are as follows:

- Assets on the MoS Balance Sheet are shown at their market value whereas assets are shown at book value for the required US GAAP approach taken;
- In addition, under MoS the liabilities are valued based on current market rates rather than locked in rates under US GAAP;
  - As a result, changes in market interest rates will impact both the asset and liability side of the balance sheet (with any mismatch resulting in a direct impact on the profit / loss of the insurer) whereas under the US GAAP used by the company, a change in market interest rates will not impact either side of the balance sheet.
- Under US GAAP, there is an explicit DAC asset on the balance sheet whereas under MoS there is no explicit DAC but rather a negative policy liability;
- US GAAP includes PADs and has a benefit reserve based on a net premium valuation, whereas the MoS reserves do not incorporate any PAD. Given the US GAAP reserves have a PAD, they are likely to be higher than the MoS reserves given this added conservatism versus a best estimate;
- Loss recognition under US GAAP for the company is done across similar business in the Asia-Pacific whereas for Clooney Life, the loss recognition needs to be done at a related product group for business in Clooney Life;
- The reserves for disabled lives and IBNR use the same assumptions.

**Marking Guide**

- **1 mark for each relevant point**  
**To a maximum of 6 marks.**

b)

TO: CFO

FROM: Actuary

You have asked me to detail the potential negative implications for Clooney Life of reinsuring its life insurance business within the group as opposed to the current arrangements with an outside reinsurer who is designated as a "specialist reinsurer" by APRA. These negative implications and potential solutions, are listed below:

1. Increased Local Capital Requirements

Issue

Under the Australian Capital requirements (known as LAGIC) asset concentration limits apply for various classes of assets. Where an asset exceeds those limits, the amount of that asset in excess of that limit becomes inadmissible for capital purposes.

The reinsurance of Clooney Life's business is currently undertaken by a "specialist reinsurer". Asset exposures to this class of reinsurer has a limit under LAGIC of the greater of 25% of the value of the assets of the statutory fund or \$20m.

However, if Clooney life were to reinsure its business with a company within the group, a lower limit of the greater of 2.5% of the assets of the statutory fund or 12.5% of the capital base would apply.

Consequently, should Clooney Life move their insurance within the group, the capital held by Clooney Life may have to increase if the low limits described above are exceeded.

Solutions

Some solutions to this issue include:

- For the parent company to post with Clooney Life collateral against the reinsurance asset to reduce the asset concentration below the lower limit;
- For the parent company to apply to APRA to become a "specialist reinsurer". It is worth noting that this is likely to require considerable effort and the outcome is uncertain;
- Working with a specialist reinsurer to take on the reinsurance and then to retrocede this to the parent. I note however, that the reinsurer is likely to charge a fee to provide this service.

## 2. Greater Volatility of Group Profits

Issue

Currently profit volatility for the group is managed by passing on risks to the reinsurance market. By keeping reinsurance risk within the group, the results of the group will likely be subject to greater volatility due to the results of Clooney Life.

Solution

- Consider using external reinsurers for high surplus covers and catastrophe type risks. Quota share type reinsurance may then be retained within the group.

## 3. Less Access to Reinsurance Expertise

Issue

Reinsurers have a view of a large section of the market. They also have specialised technical teams such as underwriting and claims management that can provide valuable support to their insurance partners.

Moving the reinsurance of this business to the parent company from the current reinsurance partner will reduce Clooney Life's access to this reinsurance support.

Solutions

- Increase Clooney Life's expertise in those areas where reinsurers are providing support. This may for example require Clooney life to increase the size of its R&D function or to make greater use of consulting partners;
- Consider splitting the reinsurance between the current reinsurer and the parent company. In this way, Clooney Life will be able to continue receiving access to the services of the specialist reinsurer.

#### 4. Cost of the Change

##### Issue

The administration of the reinsurance will need to be undertaken by the parent company. The cost of such administration will currently be covered by the reinsurer currently who is likely to benefit from economies of scale and will hence have a lower cost of performing such administration. The cost to the parent of undertaking this administration for Clooney Life, and no other companies, is likely to be significant.

##### Solutions

- Consider using third party providers with expertise in reinsurance administration to set up processes.
- Consider simpler to administer reinsurance contracts for internal reinsurance (e.g. simple quota shares or stop loss arrangements) rather than more complex structures.

##### **Marking Guide**

- **1 mark for each issue identified (max 3)**
- **1 mark for each solution suggested (max 2 for each issue) (max 6 marks)**
- **0.5 marks for use of appropriate language**

**To a maximum of 9 marks.**

c)

See attached spreadsheet for solutions.

Information that was not provided as assumptions but should be inferred by the business discussed in the question includes:

- Group business runs off over 3 years (the lapse rate column was used to do this – but different patterns could be used).

##### **Marking Guide**

- **5 marks for calculation of Individual VIF (0.5 marks for each calculation component in the spreadsheet)**
- **2 marks for calculation of Group VIF (0.25 marks for each calculation component in the spreadsheet)**
- **1 mark for stating Group risk 3 years assumption**

**To a maximum of 8 marks.**

d)

The gain full marks the candidate needs to choose any three of

- Claims Ratio
- Investment Income
- Lapse Rate
- Expense Ratio

Other possible assumptions to use are Discount Rate and Premium rate increases, although there are limited mitigation options for these.

Example of a solution:

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TO: CFO  
FROM: Actuary

You have asked me to consider three key assumptions for the calculation of the Value of Inforce Business (VIF), possible stressed values and possible mitigating actions.

I have provided detailed feedback on these questions below:

#### Claims Ratio

The VIF is very sensitive to the claims ratios assumed in the projections. An increase in future claims costs of 10% reduces the VIF by about 51% (or \$89m). An increase in claims costs by about a third would result in the VIF being reduced to zero.

However, the company can manage the claims ratio in a number of ways:

- Increases in premium rates for individual business thereby reducing the claims ratio;
- Improving claims management practices (particularly in the disability income business and for TPD group benefits) could result in reductions to claims ratios;
- Better use of reinsurance may be able to partly cap the tail of possible loss events thereby, for example, reducing the probability of having a 33% increase in claims.

#### Investment Income

The model is sensitive to investment income but relative to claims incidence rate, not as sensitive (mainly as a result of the relatively low levels of capital assumed). Reducing the investment income assumption from 3.5% to 1% results in a 19% reduction in the VIF (or \$32m). It is worth noting that the investment income assumption as it currently stands (3.5%) is low compared to historic levels. An argument could be made that this long-term projection is taking a conservative view with regards to interest rates as it currently stands. However, there is also a school of thought that the low interest rate environment is becoming a long term phenomenon.

Ways of managing the investment income risk include:

- During times of significant changes (reductions) in interest rates, premium rates on the underlying products will need to rise to compensate for the lower expected investment returns;
- Clooney Life could also investigate how well matched its asset portfolio is to its liabilities. If they are not well matched, improving the matching (e.g. duration matching of fixed interest assets) may result in less volatile experience.

#### Lapse Rate

The VIF is quite sensitive to the lapse rate assumption. Increasing the lapse rate by 50% (from 12% to 18%) results in a 50% decrease in the VIF (or \$88m). Even a smaller increase (e.g. from 12% to 13%) results in a reasonable change in the VIF (11%). Hence, the actual lapse rate is a key determinate of the actual value of this portfolio.

However, the company can attempt to manage the lapse rate in a number of ways:

- Putting in place retention strategies to try to discourage persons from lapsing their policies;
- Maintaining competitive products and pricing (which also meet profit targets);

#### Expense Inflation

The projection assumes an expense inflation level of 2% pa. If there were projected increases in expenses such that this level of inflation increased to 5%, then the VIF would reduce by approximately 36% (or \$62m).

The company can attempt to manage expense risk by careful budgeting to help ensure that expense inflation is kept in check.

#### **Marking Guide**

- **1 mark for identifying the assumption and the sensitivity of each assumption to the calculation of the VIF (max 3 marks)**
- **1 mark for each valid comment on the mitigation of the various risks (max 4 marks)**
- **1 mark for use of appropriate language**

**To a maximum of 7 marks**

**END OF PAPER**