

**Marking Guide**
**Level of Difficulty**

Question	Syllabus Performance Outcome	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1(a)	9.5	3		7		20
1(b)	5.1	2			7	
1(c)	4.1	2	6			
2(a)	14.2	4	6	2		23
2(b)	13.1	4	3	4		
2(c)	14.3	4		4		
2(d)	12.4	4			4	
3(a)	2.2	1		8		23
3(b)	2.4, 7.2	1			8	
3(c)	12.2	3	7			
4(a)	11.3	3	3			14
4(b)	11.3	3		3		
4(c)	7.1	2		5		
4(d)	7.4	2			3	
5(a)	6.4	2			7	20
5(b)	7.2	2		4		
5(c)	15.3	5			9	
<b>TOTAL</b>			<b>25</b>	<b>37</b>	<b>38</b>	<b>100</b>
<b>TARGET</b>			<b>15-30</b>	<b>35-45</b>	<b>30-45</b>	<b>100</b>

Answer all 5 questions

**QUESTION 1**
**(20 Marks)**

As a newly qualified actuary you have recently been given responsibility for the pricing of group life insurance for an Australian life insurance company. The group life business offers a death benefit to which additional TPD benefits can be added. No death benefit is payable once a TPD benefit has been paid and the TPD benefit is equal to the death benefit. TPD is defined as “unable to perform at least one of the major duties of your job”. The underwriting policy includes automatic acceptance and underwriting for benefits in excess of the automatic acceptance limit.

After reviewing the numbers provided by the finance department, the Head of Group Business (who has a sales background and is not an actuary) has written to you noting that the following numbers suggest pricing problems for TPD business. The Head of Group Business is concerned that Death insurance is subsidising TPD insurance and has suggested that premiums for TPD be increased and those for Death be reduced.

Group Life Portfolio	Premiums	Claims	Ratio
Death	2,000,000	1,400,000	70%
TPD	1,000,000	1,150,000	115%
Total	3,000,000	2,550,000	85%

Note: In the above table, premiums are on an “earned” basis, claims are on an “incurred” basis and there is no reinsurance. You can assume that there are no problems with the calculation of earned premiums or incurred claims.

- a) Draft a reply to the Head of Group Business. **(7 Marks)**
- b) The Head of Group business has been negotiating with a newly established mining company which is interested in providing group insurance benefits for its workforce. The Head of Group Benefits is proposing to offer a small amount of TPD as compulsory cover for all members in the base product, and allowing individual members the option to increase their TPD cover for an extra premium. Discuss the issues you need to consider for this proposal, including (but not limited to) automatic acceptance, underwriting and the TPD definition. **(7 Marks)**
- c) Outline how you would implement an Enterprise Risk Management (ERM) framework for managing the risks of the current group life portfolio. **(6 Marks)**

**QUESTION 1 SOLUTION**

a)

Dear Head of Group Business,

Thank you for your questions about the profitability of group business. I always welcome a chance to have discussions such as this.

The numbers presented have been derived from accounting information. Whilst they are arithmetically correct the numbers in each column are not comparable. The comparison shown understates the income available to pay TPD claims and as a result the ratio of claims divided by premiums is overstated. On the other hand the cost of death claims has been reduced by the death claims not payable because there has been a TPD claim and therefore the death claim experience is understated. The comparison provided does not present premiums and claims on a consistent basis and therefore the ratios can be misleading.

Some more information on each of these items is provided below.

**Income Available for TPD is Understated**

As you know we charge premiums for death benefits and an additional premium for TPD benefits. The TPD premium does not represent the cost of TPD benefits but the difference between a premium which covers death only and a premium which covers death and TPD.

Where a policy includes a TPD benefit, no death benefit is paid if a TPD benefit has been paid. As a result, the death benefits paid will mostly be for death by accident and those members who die after an illness would often have received a TPD benefit before death. This means that the cost of death claims from policies which have a TPD additional benefit will be lower than cost of death claims from policies which provide for death only benefits. This lower death claims experience has been included in the death benefits recorded in the table you provided. This has resulted in the favourable ratio of death claims divided by death premiums.

**Death Claims Experience is Understated**

As stated above, where a policy includes a TPD benefit, no death benefit is paid if a TPD benefit has been paid. This means that TPD claims are paid for by the TPD premiums paid plus the savings in death benefits paid for by the death benefit premium. It is this second component that is missing from the comparison you have provided.

To have a fair comparison the figures should show a comparison of premiums and claims for death only contracts and premiums and claims for death and TPD contracts.

**Conclusion**

Looking at the total claims ratio is a good indication of the total experience although adjustment is needed for claims that have been incurred but not yet notified. The overall ratio of 85% is within the expected range as our expense target expense and profit margin is in the range of 10-20%. It is possible that any one year can have an unusually good or bad experience so we tend to look at trends over a number of years.

At this stage I do not believe that there is a cross subsidy but I will make further investigations to compare expected claims and actual claims for Death only policies

and Death and TPD policies and inform you of the results.

Again thank you for your enquiry.

### **Marking Guide**

- **2 marks for clearly stating the fact that the numbers are not directly comparable as there is a mismatch between the calculation of premiums and the payment of claims, 1 mark if point is not so clear but the student seems to understand the issue**
- **1 mark for style with opening comment**
- **1 mark for closing comment**
- **1 mark for saying why death claims ratio is understated**
- **1 mark for saying why TPD is overstated**
- **1 mark for needing to do the analysis separately for Death only and Death and TPD**
- **1 mark for valid comment on combined ratio of 85%**
- **1 mark for other valid points to a maximum of 2 marks**
- **To a maximum of 6 marks**

**Total Marks = 7 SJ**

b)

Mining is a high risk industry, especially for TPD. Making the benefit optional would expose the group life pool to anti selection and make rating difficult. In addition the occupation definition is generous, especially for a manual occupation in mining and consideration should be given to a less generous definition such as "any occupation", especially if the benefit is optional.

At this stage it is not clear whether the compulsory TPD benefit will reduce the amount of death benefit payable, if no death benefit is payable or if the payment of the compulsory cover does not affect the death benefit. Clarification is needed on this point.

If the additional TPD benefit is to be selected by the member then, under the existing policy wording, the amount of benefit cannot be greater than the death benefit or the death benefit less the compulsory benefit and any benefit paid must reduce the amount of death benefit payable if the amount of selected benefit is less than the death benefit.

Automatic acceptance is generally only provided when cover is compulsory or optional choice is very high. Automatic acceptance is therefore appropriate for the small compulsory TPD benefit. However if automatic acceptance is to apply to the optional benefit then the take up rate would need to be high and the amount of cover should also be formula driven rather than selected by the life insured. The cost of full underwriting would be high compared to the premium involved so if any underwriting is required it should be on a simplified basis.

The final decision would depend on the premium rate, but given the risks it is likely that a suitable premium rate would be quite high and not acceptable to the trustees.

**Marking Guide**

- 1 mark for saying that mining is high risk
- 1 mark for saying that the definition is too generous
- 1 mark for automatic acceptance applying to small benefit
- 1 mark for comments of TPD affecting death benefit
- 1 mark to maximum TPD cover being the death benefit
- 1 mark for additional automatic acceptance requiring compulsory cover or high acceptance
- 1 mark for determining amount of cover by formula
- 1 mark for comment on underwriting costs
- 1 mark for comment on premiums
- 1 mark for other valid comments to a maximum of 2 marks
- To a maximum of 7 marks

**Total Marks = 7 CJ**

c)

The ERM framework is

- Identify Risks
- Analyse Risks
- Manage Risks
- Monitor and Report
- Review and Improve Process

For the existing portfolio this involves

**Identify Risks**

Look at various sources to develop and maintain a list of risks for the company. Sources include analysis of past actual risks, opinions from management, industry body and regulators as well as consultants

**Analyse Risks**

- Analyse extreme risks, such as work place accidents involving a number of workers. This would involve some risk severity and risk likelihood quantification. Risk severity is often analysed by looking at the likelihood of risks in excess of a certain amount (sometimes called Value at Risk –VaR). (1 mark)
- Determine Risk tolerance for the organisation. This could be by reference to impact on profits, capital or reputation (½ mark)
- Develop a risk severity matrix mapping likelihood of risks against impact of risks ( ½ mark)

**Manage Risks**

As a result of the above steps the company needs to decide whether to retain, reduce, remove or avoid each of the risks identified along with quantifying the impact of each of these actions on the risk exposure for the company.

**Monitor and Report**

Regular monitoring and reporting should occur; in addition reporting should be updated whenever a significant risk has occurred. For specific risks there should be a check that the expected response has been followed and whether or not any changes in the process are required.

**Review and Improve the Process**

Part of monitoring and reporting should include continual improvement recommendations but at regular intervals it is advisable to have a fresh look at the process and in particular whether the risks that have occurred were within the risks identified and analysed.

**Marking Guide**

- 1 mark for identifying all the steps in the process
- 2 marks for Analyse Risks
- 1 mark for comments on each other step,  $\frac{1}{2}$  mark for each correct comment on the point
- To a maximum of 6 marks

**Total Marks = 6 KU**

**QUESTION 2**
**(23 Marks)**

You have been provided with the following profit test results for a single premium term insurance contract which covers risk for a period of three years. There is no tax payable, transfers are made at the end of each year and are equal to the value of assets in excess of the valuation liability.

Year	Policies at Start	Premium	Reserve BOY	Initial Expenses BOY	Renewal Expenses EOY	Claims EOY	Reserve EOY	Transfer before Interest	Interest	Transfer
1	1,000	2,400,000	2,160,000	120,000	49,950	300,000	1,438,560	491,490		
2	999		1,438,560		49,850	600,000	717,840	70,870		
3	997		717,840		49,700	900,000	0	-231,860		
	994									

**Note:** "BOY" means beginning of year and "EOY" means end of year

**a)**

- i) Calculate the transfer for each year, assuming investments earn a 5% per annum return. **(3 Marks)**
- ii) Calculate the Profit Margin as a percentage of premium. **(2 Marks)**
- iii) Calculate the Value of New Business transfers at issue using a 15% discount rate. **(1 Mark)**
- iv) Comment on the internal rate of return. **(2 Marks)**

- b) What adjustments would you make to the valuation liability and how would this impact the transfers, profit margin and the present value of transfers at issue? Confirm your comments by giving an alternative basis and calculating the profit margin on the alternative basis. **(7 Marks)**
- c) Discuss the suitability of using the profit margin, internal rate of return and the present value of transfers at issue for determining the appropriate premium rate for this policy. **(4 Marks)**
- d) Describe how you would determine a risk neutral price for this product. **(4 Marks)**

**QUESTION 2 SOLUTIONS**

a)

i)

To calculate the transfer it is first necessary to calculate the assets available for investment.

At the start of year 1 the assets available for investment are the premium received less initial expenses. For year 2 and year 3 the assets available for investment are equal to the liability at the end of the previous year as any excess is transferred and there are no expenses or claims at the start of year 2 and year 3. The calculations are:

Year	Item	Assets available at Start	Interest Rate	Interest
	Premium	2,400,000		
	Initial Exp	-120,000		
1		2,280,000	5.00%	114,000
2	Liability	1,438,560	5.00%	71,928
3	Liability	717,840	5.00%	35,892

Year	Transfer before Interest	Interest	Transfer
1	491,490	114,000	605,490
2	70,870	71,928	142,798
3	-231,860	35,892	-195,968

**Marking Guide**

- ½ mark for Assets available for investment start year 1
- ½ for assets available for investment start of year 2 and year 3 (both for ½ mark, zero otherwise)
- ½ mark for year 1 interest
- ½ mark for year 2 and year 3 interest (both for ½ mark, zero otherwise)
- ½ mark for year 1 transfer
- ½ mark for year 2 and year 3 transfer (both for ½ mark, zero otherwise)

**Total = Maximum of 3 marks KU**



ii)

Profit Margin

Year	Transfer before Interest	Interest	Transfer	Iterative Calculation of NPV
1	491,490	114,000	605,490	536,895
2	70,870	71,928	142,798	-41,751
3	-231,860	35,892	-195,968	-186,636
NPV of transfers at 5%				536,895
PV of Premium				2,400,000
Profit Margin				22.37%

**Marking Guide**

- 1 mark for calculating NPV of transfers
- 1 mark for profit margin

**Total Marks = 2 KU**

iii)

Embedded Value

Year	Transfer before Interest	Interest	Transfer	Iterative Calculation of EV at 15%
1	491,490	114,000	605,490	505,637
2	70,870	71,928	142,798	-24,008
3	-231,860	35,892	-195,968	-170,407
Embedded Value at 15%				505,637

**Marking Guide**

- 1 marks for calculating NPV of transfers. Give ½ mark if process is correct but answer is wrong

**Total = 1 marks KU**

iv)

Internal Rate of Return

The internal rate of return cannot be calculated to give a sensible answer as there is no first year investment, total cash flows are positive and the PV increases as the rate of interest increases from 0%

**Marking Guide**

- 1 mark for stating that IRR cannot be calculated
- 1 mark for stating any reason why

**Total = 2 marks SJ**

**Overall Total Marks = 8, 6 KU, 2SJ**

b)

The valuation basis is too weak as can be seen from the negative transfer in year 3. The straight line valuation liability does not reflect the shape of risk. The reserve basis needs to be stronger and reflect the shape of the risk and give positive transfers in each year after interest earnings.

Increasing the liability does not have any effect on the profit margin as the discount rate is the rate of interest.

(Note to markers – any basis which gives positive transfers after interest in years 2 and 3 is acceptable but the profit margin must be 22.37%).

A liability which is 90% of  $5/6^{\text{th}}$  and then 90% of  $3/6^{\text{th}}$  of the premium at the end of year 1 and year 2 would give a better shape of earnings and make an allowance for expenses. This reserve basis is shown below

Year	Policies at Start	Premium	Reserve BOY	Initial Expenses BOY	Renewal Expenses EOY	Claims	Reserve EOY	Transfer before Interest	Interest	Transfer
1	1,000	2,400,000	2,160,000	120,000	49,950	300,000	1,798,200	131,850	114,000	245,850
2	999		1,798,200		49,850	600,000	1,076,760	71,590	89,910	161,500
3	997		1,076,760		49,700	900,000	0	127,060	53,838	180,898
	994									

As expected, the profit margin is 22.37% as shown by the following calculations:

Year	Transfer before Interest	Interest	Transfer	Iterative Calculation of NPV
1	131,850	114,000	245,850	536,895
2	71,590	89,910	161,500	317,889
3	127,060	53,838	180,898	172,284
	NPV of transfers at 5%		536,895	
	PV of Premium		2,400,000	
	Profit Margin		22.37%	

**Marking Guide**

- **1 mark for stating that the valuation liability is too weak or that the valuation basis needs to be strengthened**
- **1 mark for saying the basis should result in positive earnings each year**
- **1 mark for saying profit margin does not change**
- **1 mark for saying VNB reduces**
- **1 mark for giving a new basis**
- **2 marks for showing the profit margin does not change. Give proportionate marks for correct calculations remembering that this is just a repeat of calculations from a)**

**Total Marks = 3 KU, 4 SJ**

c)

The profit margin measures the profit of a product without allowing for the cost of capital. As the current product requires no capital it is a suitable measure for determining the premium rate for this product. However, it is common for companies which use this measure to use different target or minimum margins for products with different risk and capital requirements.

Internal rate of return is a good measure for products with significant capital requirements. When products have low or no capital then internal rate of return is not a good measure as returns cannot be calculated or are very high. Very high returns do not measure profitability but reflect low capital requirements or sometimes a mistake in the calculations. Moreover a very high rate of return over a period implicitly assumes that returns can be reinvested at the same very high rate of return. Internal rate of return is not a good measure of profitability for this product.

The present value of new business transfers at issue combines a cost of capital measure (the discount rate) with a profit measure (the present value). It should be noted that a policy that has an internal rate of return equal to the discount rate will have a zero present value of transfers. This measure is suitable for determining the premium rates for this policy as it can handle the problem of no initial investment.

**Marking Guide**

- **½ mark for comment on each measure**
- **½ mark indicating whether or not it is a suitable measure**
- **½ mark for why suitable or not**
- **To a maximum of 4 marks**

**Total Marks = 4 SJ**

d)

A risk neutral price would require risk neutral decrement assumptions, a risk neutral investment return and a risk neutral discount rate (these last two items are the same).

Risk neutral assumptions can be obtained from market data for investment return. Typically duration specific zero coupon government bond returns are used.

Risk neutral decrement assumptions generally do not have a market equivalent although it may be possible to obtain some guaranteed reinsurance premium rates. However as this is a single premium contract with no surrender value and there is no reason for the life insured to lapse, zero lapses would seem to be the appropriate assumption. For mortality the best estimate assumption should be used as this is neither an overestimate nor an underestimate.

Tax rates and the tax basis are determined by the government from time to time and unless a review is under way, the current basis would normally be used

The valuation basis is not relevant as the earning rate and the discount rate are the same.

The present value of transfers at issue on risk neutral assumptions would need to be zero or greater. A value of greater than zero would indicate that the company requires a return in excess of a risk neutral return but in a competitive risk neutral market this should not be possible!

**Marking Guide**

- 1 mark for describing method
- 1 mark for describing investment/discount assumptions
- 1 mark for zero lapses
- 1 mark for best estimate mortality
- 1 mark for describing how to set the price
- To a maximum of 4 marks

**Total Marks = 4 CJ**

**QUESTION 3**
**(23 Marks)**

For a number of years you have been working in the retail pricing area of an Australian bank, pricing home loans and banking deposit products. The bank you work for has recently purchased a smaller Australian bank which has an Australian life insurance company which only writes non superannuation risk insurance related to credit life and mortgages. Premiums are charged on a monthly basis according to the amount of loan outstanding at the start of the month.

The “One Bank” project team is looking at how to integrate the acquisition into the new structure. In particular the project team has asked for your opinion on the restructure proposals as you have previous experience working in an Australian life insurance company.

- a) The “One Bank” project team has asked you to identify three advantages and three disadvantages for each of the following two proposals

Option 1 – Product Actuary: The Appointed Actuary works for the CFO, with the pricing of life insurance products being delegated to a Product Actuary in the Product Division.

Option 2 – No Product Actuary: The Appointed Actuary works in the product area and is responsible for pricing life insurance products as well as the statutory responsibilities. There is no Product Actuary role.

Draft your response and give, with reasons, your preferred approach. **(8 Marks)**

- b) The life insurance company has previously paid a commission to the bank but the bank is adopting a relationship manager role. The bank has suggested that the insurance company should pay a share of the salary for each relationship manager in addition to the usual commission. Commission rates will remain the same at 40% of first year premium as there are significant sales volumes expected from the new model. Projections using these sales volumes show that the overall commission plus expense ratio as a percentage of premiums is forecast to remain steady over the 3 year projection period. Discuss this proposal and its financial impact on the life insurance company as well as any further investigations you would like to make. You can ignore any taxation issues. **(8 Marks)**

- c) The “One Bank” project team has asked you to briefly outline the product development process assuming Option 1 was selected. The outline should identify each step, give a brief description of what is involved in each step and indicate whether the bank or the life insurance company is responsible for the delivery of each step. You can ignore the existing product development process for bank products and you can assume that marketing and product design will be handled in the Product Division of the bank and that distribution will be handled in the Retail Network division of the bank. You can also assume that administration and actuarial work will be carried out in the life insurance company. **(7 Marks)**

**QUESTION 3 SOLUTIONS**

a) Dear Project Team,

You have asked me to identify the possible advantages and disadvantages of Option 1 and Option 2. I have identified potential advantages and disadvantages below but would like to emphasise that good communication between all the parties involved is the key to making the product development project a success.

(Markers please note that only three advantages and disadvantages are required even though the model answer gives more)

**Option 1 – Product Actuary - Advantages**

Better team work with marketing

Quicker turnaround of ideas

Focus on product development, not interrupted by other actuarial priorities

Constructive tension with Appointed Actuary – ensures that reserving issues are understood with the Marketing area

Separation of product and reserving issues means a clear focus for each area

**Option 1 - Product Actuary - Disadvantages**

Product Actuary may make a decision on reserving basis which is not acceptable to AA

Sets up a conflict position between AA and Marketing

Slower resolution of AA issues with product development as more parties are involved

AA does not have a full appreciation of marketing/product issues

Leads to continuous product development and release of products (can be an advantage or disadvantage)

CFO will need to make greater effort to get involved

Appointed Actuary has a reduced knowledge of the company as a whole

May have higher salary costs

**Option 2 – No Product Actuary - Advantages**

Better teamwork within AA area

Quicker turnaround of AA issues

Avoids conflict between areas

AA has better understanding of reserve issues in the product development process

Actuarial staff able to work on non-product issues over the year

CFO has more direct involvement through a direct reporting line

May have lower salary costs

**Option 2 – No Product Actuary - Disadvantages**

More conflict with Marketing as they do not have direct understanding of actuarial issues

Longer turnaround times with marketing

Actuarial resources for pricing may be limited in peak end of year times

No separation of duties

Lack of clear focus on desired outcomes for pricing vs. valuation

**Recommendation**

The student can recommend either approach provided there is a reason e.g.

Option 1 is recommended because of faster turnaround times and a clear focus on outcomes for the product area and CFO area.

Option 2 is recommended as there is a clear focus on the overall financial issues for the company within one area. Marketing can therefore focus on customer specific issues.

**Marking Guide**

- **Note that only 3 advantages and disadvantages are required, even though the model answer gives more**
- **1 mark for reply style with opening and closing comment**
- **½ mark for each of the 3 advantages or disadvantages, 1 mark for 2 and ½ mark for only one, giving 6 marks in total**
- **1 mark for recommendation with reason. Zero marks if no reason**

**Total Marks = 8 SJ**

b)

The ratio of commission and expenses to premium is not a good measure of profitability as it is affected by growth and the fact that commission is an upfront payment repaid by future premiums.

Before making a final decision the life insurance company should investigate the profitability of new products on the revised assumptions as well as a projection of profits on alternative commission and expense scenarios.

In particular, given that commission is paid on the first year premium and not the renewal premium, an increase in expense and commission ratio would usually be expected. The question states that the commission and expense ratio is forecast to remain steady which means that the steady ratio has most likely come from expense control as commissions are still high at 40% and there are additional costs for relationship managers. Further investigations should include the expense assumptions and in particular:

- Has allowance been made for the costs of processing increased volumes as well as volume related distribution expenses?
- Some expenses are semi fixed and will increase in steps – this typically happens with computer hardware and accommodation
- Is essential expenditure being deferred? E.g. IT related expenses

- Have some depreciation items ceased e.g. the end of the depreciation period for software. If so are these items required to be replaced?

Sales volumes are also a key component in the projections. Investigations should include:

- The number of relationship managers
- Expected extra leads
- Expected conversion from lead to sale
- Expected premium per sale

The past experience of the bank and best practice in the banking industry should be used as benchmarks

The financial impact of the proposal is to increase the volatility of earnings due to the fixed charge for relationship managers. There is no mention of performance criteria for relationship managers who sell the whole range of bank products including mortgages. Product profitability is also more volatile. If business volumes fail to materialise, then profitability will fall or prices will need to be increased to maintain profitability.

### **Marking Guide**

- **2 marks for comment on whether or not the commission and expense ratio is a good measure and why**
- **1 mark each for comments on expense investigations and volumes to a maximum of 4 marks**
- **1 marks for comments on financial impact to a maximum of 2 marks**
- **Up to 2 marks for other valid comments**
- **To a maximum of 7 marks**

**Total Marks = 8 CJ**

c)

The recommended product design process is:-

### **Initial Decision**

This will require feedback from the bank, bank distribution and the life insurance company about market trends and customer needs. The bank is responsible for this step

### **Design**

The initial decision should have specified some requirements for the product. The product design division of the bank (in the life company is also acceptable but there must be an indication of which area) will be responsible for developing a product to meet these requirements or negotiating any compromises. The actual pricing will need to be done by the actuaries who work in the life insurance company

### **Project Organisation**

The product development project will need to be led by a project Manager. Project management is a skill and the project manager can come from either the bank side or the life insurance company



**Final Decision**

The decision to launch a product needs to be made by the management life insurance company after taking advice from the appointed actuary and approval from the product owner in the bank

**Implementation**

Implementation is systems focused in the life insurance company but will include testing of interfaces to the bank. The life insurance company needs to be responsible for this

**Launch**

The launch will need to be supported by the product pricer from the company, the marketing staff from the bank and the bank distribution staff. As well as the launch there will need to be follow up training sessions in the bank. Again, the life insurance company needs to be responsible

**Feedback**

All parties are responsible for feedback but there should be a formal process to consolidate this after a specific period

**Marking Guide**

- ½ mark for each step with some description or comment on the step (note these steps are bookwork in the textbook so the student should be expected to use this structure)
- ½ mark for who is responsible. Any reasonable mix of responsibilities is acceptable

**Total Marks = 7 KU**

## QUESTION 4

(14 Marks)

You are a Product Actuary who is calculating the Value of New Business for the non-participating product portfolio of an Australian life insurance company.

- a) Describe how you would determine the gross best estimate investment return assumption to be used for the profit testing of non-participating products. (3 Marks)
- b) Give a set of individual asset return assumptions which you believe are currently appropriate. Return assumptions are needed for inflation, cash, government fixed interest, commercial fixed interest, commercial property and listed equity asset classes. (3 Marks)
- c) One of the products you are reviewing is directly linked to the All Ords accumulation index of the ASX (Australian Stock Exchange) and the unit price is determined as the index value divided by 1000. In the normal course of events, premiums and claims notified today have units allocated using the price calculated from the index value for the close of business today, but funds are not invested until the following business day. Transaction costs are 0.1% of actual trades. Daily unit fees (paid by deducting units) are .005% of the number of units multiplied by the unit price. Units deducted for fees are held in the shareholders account and redeemed at the end of the month at which time they are transferred out of the unit fund.

Discuss the risks for this product and unit price design.

(5 Marks)

- d) The Marketing Department has suggested extending this index concept to overseas markets and the Appointed Actuary has asked for your advice on this proposal. Discuss the extra risks for overseas markets. Give, with reasons, your advice to the Appointed Actuary on whether or not you would accept or reject the recommendation. (3 Marks)

**QUESTION 4 SOLUTIONS**

a)

The starting point for long term best estimate assumptions would be the long term yield on 10 year Commonwealth bonds. The return assumptions for the other classes given in the question can be determined by adding or subtracting margins.

These can then be combined to reflect the intended asset mix. Ideally the asset mix should reflect a policy of matching assets and liabilities with a hold to maturity approach to investments. Any departure from a matched investment policy involves an extra risk and return which should accrue to shareholders who will bear the cost if events are unfavourable.

The overall return can then be modified to allow for the current yield on new investments as well as short term expected trends in returns.

**Marking Guide**

- **1 mark for base plus margins**
- **1 mark for matched asset mix**
- **1 mark for short term trends**
- **1 mark for other points but note that the question concerns new business and non par products**
- **To a maximum of 3 marks**

**Total Marks = 3 KU**

b)

The current 10 year bond rate is around 4%.

Inflation is in the 2% to 3% range so cash should be above 3% but below 4% say 3.25%.

Corporate bonds have a margin of 1-2% over government bonds of the same duration. Based on the above a 3-5 year government bond would yield 3-4% so a corporate bond of 4-5% would seem to be appropriate.

Equities are often assumed to yield an extra 3-6% over bonds so 7% - 10% would seem to be reasonable.

Property is generally assumed to yield 1% less than equities so 6-9%

**Marking Guide**

- **½ mark for each of six classes within a reasonable range and relative yields**

**Total Marks = 3 SJ**

c)

The risks arising from the product design are:

- Mismatches between the time the unit price is determined and the time the actual investment is made will result in profits and losses for shareholders
- There is no explicit allowance for transaction costs so transaction costs are paid out of the shareholders fund

- Unit fees are held until the end of the month before they are sold which creates volatility in the amount of fees
- There could be an error in the published index value which would affect transactions. The policy document should have a provision allowing the price to be suspended if there has been an error, or an alternative price used on approval by the Appointed Actuary
- It might not be possible to buy assets in the market e.g. systems failure or market break mechanisms. Again, there should be a provision allowing for an alternative
- Timing and volume of transactions means that investments cannot be made in a timely basis to match the index
- Index tracking error will add to profit and losses for shareholders
- If synthetic approach to investment then there will be collateral issues

**Marking Guide**

- **1 mark for each point**
- **Maximum of 5 marks**

**Total Marks = 5 SJ**

d)

Overseas markets involve extra risks because of market closing times being different to local market closing times. There is also the issue of currency risk assuming the policy would be in Australian currency and again the time at which currency is converted. Currency would generally need to be converted before the funds are invested. These issues mean that there will be significant extra administration costs.

These risks should involve an extra fee but as this is not proposed I would not support the recommendation

**Marking Guide**

- **1 mark for market closing**
- **1 mark for currency**
- **1 mark for recommendation**

**Total Marks = 3 CJ**

**QUESTION 5**
**(20 Marks)**

You are a qualified Actuary working for an overseas life insurance company which commenced writing regular premium participating whole of life policies 10 years ago. The participating fund is open to new business. For many years the company has been paying bonuses which are the same as included in policy illustrations and which assumed a 6% return on investment.

Under local regulations, participating business is written in a separate fund and premiums are calculated using a traditional formula approach. The interest rate used in the formulae must be 3% per annum and companies must use the same interest rate for premiums and cash values, both of which are guaranteed. Bonuses are all declared as cash payments. Shareholders receive a distribution of 25% of the cash bonus declared.

Regulations also state that policy funds for participating policies must be invested in special government bonds which are only available to financial institutions. The special government bonds are only sold for a ten year term and historically have been issued at par with a coupon of 6% per annum. The special bonds can be sold in an active listed market but only to other financial institutions. However, in the past year new special government bonds have been issued at par with a 2.5% coupon per annum and future issues seem likely to stay at this level.

The regulator is still considering lowering the rate of interest used to calculate the premium rate but regulations are expected to take some time to finalise.

The Chief Actuary has asked you to prepare some written comments on some specific areas that they need addressed for a report they are preparing. Your comments should include recommendations for further investigations and cover the following areas:

- a) The impact that the current investment climate has on the ability of the invested assets to cover the product guarantees, both now and in the future. (Note: You do not need to discuss valuation regulations) **(7 Marks)**
- b) Ceasing to write new participating business until the regulations are changed. **(4 Marks)**
- c) The factors you would consider when determining a suitable basis for offering conversion from a regular premium participating whole life product to the company's existing regular premium unit linked product. These factors should include, but not be limited to, consideration of the impact on the customer, the participating fund and the shareholders (2 marks for each of these factors). The existing unit linked product has a premium charge of 5% of all premiums and a management charge of 2% of assets. There are no other charges or penalties and the full value of units is payable on surrender or maturity. **(9 Marks)**

**QUESTION 5 SOLUTIONS**

a)

The guarantees in the portfolio are that:

- Future premiums will be invested at rates of return sufficient to meet the future death benefits. Ignoring other sources of profit, a rate of 3% is required to meet minimum return guarantees
- Existing assets will be reinvested at returns sufficient to meet the future death benefits.
- Current surrender values can be met from the assets of the fund. Asset values would have increased as a result of the lower interest rates and hence this is not an issue.

The current portfolio of policies has been written over the past ten years and therefore funds still need to be invested each time a premium is paid or an interest payment is received. These new investments can only earn 2.5% which is less than the 3% required to meet minimum guarantees.

In addition, as the existing 10 year bonds mature they can only be invested in new bonds earning 2.5%, which is less than the 3% required to meet guarantees.

A best estimate valuation of the business needs to be performed assuming a 2.5% investment return and best estimate assumptions. Given the low interest rates it would be prudent to assume no surrenders or lapses. This best estimate liability can then be compared to the market value of assets to determine whether or not further capital is required to meet the deficiency for existing business.

The dividend rates assumed should be based on the lowest expected dividends and a nil dividend run should be used.

By including various levels of future new business it will be possible to determine when the solvency of the company will be impacted by the CEO's suggestion

For new business, reserves will need to be established using a 2.5% interest rate which will probably result in a deficiency reserve which will require capital. There may be existing capital but is this an appropriate use of the existing capital? Depending on the result of the above investigations it may be preferable for the shareholders to provide extra capital to cover deficiency reserves until the regulations are changed and a new product is launched.

**Marking Guide**

- 1 mark for identifying minimum 3% return as guarantee
- 1 mark for problem with investing premiums 1 mark for problem with maturing bonds
- 1 mark for comment on asset values increasing and hence can cover surrender values
- 1 mark for needing a best estimate valuation at 2.5%
- 1 mark for discussing cash bonus rate to be used
- 1 mark for identifying nil or very low surrenders
- 1 mark for deficiency reserve issue
- 1 mark for source of capital
- 1 mark for other valid points to a maximum of 2 marks
- To a maximum of 7 marks

**Total Marks = 7 CJ**

b)

Ceasing to write new business will protect the solvency of the participating fund and enable higher (but reduced) cash bonuses for existing policyholders. However there are implications for the company and the distribution network.

The company will have an expense structure in place to support the writing of participating new business. Whilst some of these expenses will be variable, most will be fixed. Where will these expenses be allocated? Given that the situation is temporary it may be preferable that the expenses continue to be allocated to the participating fund. Alternatively these expenses can be allocated to the other funds especially if these funds write more new business as a result of the company ceasing to write participating new business. A suitable outcome would be for the other funds to be charged the expenses related to any increase in new business and for the participating fund to carry the balance. This would need to be agreed with the company auditors.

Distributors may also be seriously affected by ceasing to write new participating business. This could be offset somewhat by increasing commissions on other business for a short period, but this will reduce shareholders profits. However, lower profits may be preferable to losing the distribution altogether.

Now might also be a good time to develop some alternative products for new business in the non-participating funds. Even when the new regulations are introduced, there will be some lead time in developing new products. In this case it would be advisable to begin producing some possible products so the product development issues can be addressed sooner rather than later, particularly as any new product would more than likely involve a new bonus series.

**Marking Guide**

- 1 mark for impact on expense of other funds
- 1 mark for allocation basis for Participating Fund 1 mark
- 1 mark for impact on distribution
- 1 mark for alternative new products
- 1 mark for draft products being developed now
- 1 mark for each other valid comments to a maximum of 2 marks
- To a maximum of 4 marks

**Total Marks = 4 SJ**

c)

In offering a conversion to a unit linked contract it is imperative that the company make full disclosure of all the facts and cannot be accused of "false and misleading" conduct

Full disclosure should include the fact that the customer is giving up a guarantee on existing funds and future premiums. The customer should be provided with illustrations showing the impact of continuing the existing policy, making the policy paid up and taking out a new policy (the new policy should not have another series of initial charges as the customer has already paid these once) and a full conversion of the existing policy and future premiums to a unit linked policy. Of course, the illustrations would need to make it clear that unit linked results are not guaranteed

The factors included in the basis can be analysed from the point of view of the customer, the statutory fund and the shareholders

### **Customer**

The customer has the advantage of being able to access higher investment returns (at a higher risk) but loses the value of the guarantee. However, the value to a customer of this will depend on the customer's needs and expectations.

The transfer value offered to a new contract should reflect this and at a minimum be the best estimate of the policy liability and the current surrender value. There should be no initial charges as the customer has already paid to set up the existing policy. Future charges should be based on the charges offered in comparable products.

An option may be to include a guaranteed unit for the transfer value.

### **The Statutory Fund**

The statutory fund will need to establish deficiency reserves for these contracts. The capital to support this will need to come from the estate, reduction in bonuses or shareholders or a combination of these sources. A transfer value of up to the new reserve (including the deficiency reserve) would be an improved result for the statutory fund.

### **Shareholders**

Because of the deficiency requirements it is unlikely that there will be any future bonuses on these policies and therefore no shareholder dividends. On the other hand there will be shareholder dividends on the replacement unit linked contracts. Shareholders could therefore afford to offer an extra incentive such as a conversion commission or lower fees to recognise this fact.

### **Further Investigations**

Further investigations should include modelling the financial impact e.g. embedded value impact of the various conversion bases which could be offered. As guarantees are involved there should also be some stochastic testing



**Marking Guide**

- 1 mark for recognising disclosure risk
- 2 marks for comments on impact on customers , Participating Fund and Shareholders, being 1 mark for identifying an issue and 1 mark for what it means for the basis
- 1 mark for further investigations
- 1 mark for stochastic testing
- 1 mark for each extra point
- To a maximum of 9 marks

**Total Marks = 9 CJ**

**END OF PAPER**