

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORTS**

September 2020

**Subject SP2 - Life Insurance**

**Specialist Principles**

### **Introduction**

The Examiners' Report is written by the Chief Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Mike Hammer  
Chair of the Board of Examiners  
December 2020

**A. General comments on the aims of this subject and how it is marked**

1. The aim of the Life Insurance Specialist Technical subject is to instil in successful candidates the principles of actuarial planning and control, and mathematical and economic techniques, relevant to life insurance companies. The candidate should gain the ability to apply the knowledge and understanding, in simple situations, to the operation, on sound financial lines, of life insurance companies. The life insurance products covered by this subject exclude health and care insurance products covered by the Health and Care Specialist Technical subject.
2. The Examiners' Report covers more points than would be expected to get full marks. This is so that alternative approaches to questions by different candidates can be accommodated. The Examiners may also award marks for valid points that are not included in the marking schedule.
3. Candidates are expected to show knowledge of the relevant content of the Core Reading, and be able to apply this knowledge where appropriate.

**B. Comments on candidates' performance in this diet of the examination.**

Questions that focussed on knowledge of the Core Reading, such as 2, 4(i) and 7(i) and (ii), were generally well answered by well-prepared candidates.

In the higher mark application questions, stronger candidates generated the required breadth of points, using the specifics of the question, rather than focussing on a smaller number of themes, e.g. questions 7(iii), 8(iii) and (iv) and 9(ii), and these proved to be questions which differentiated candidates.

**C. Pass Mark**

The pass mark for this exam was 60.  
599 presented themselves and 308 passed.

## Solutions

### Q1

- The bancassurer is likely to have lots of data on its customers available, [½]
- ...due to its size and because it has been operation for many years. [½]
- The technology and expertise to make improved use of this data is now available [½]
- The business written is likely to cover a number of different types of risk [½]
- (e.g. mortality, critical illness, permanent health). [½]
- Analysing its data may help it to understand better the underlying risks, [1]
- and the factors that influence the risks [½]
- This may allow it to classify its risks better, [1]
- and as such give individual customers an accurate rating [½]
- The bancassurer may also then be able to select the preferred risks... [½]
- ...improving its pricing approach... [½]
- ...and/or adapting its products to reflect the additional information. [½]
- Monitoring the available data may also allow the insurer to better drive experience, [½]
- through early identification of changes in individual insured risks or [½]
- potentially through being able to intervene and influence customer behaviours. [½]
- The bancassurer may offer incentives to customers to reduce its risks. [½]
- For example lower premiums with evidence of a healthy lifestyle [½]
- (e.g. visits to the gym). [½]
- e.g. Free fitbits and apps to monitor lifestyle. [½]
- Overall, this could provide a competitive advantage... [½]
- ...and lead to improved profits. [½]

**[Total marks available 11 ½, maximum 5]**

*This question was fairly well answered with most candidates able to suggest a range of reasons. Stronger candidates expanded upon each of the reasons to consider the benefits of using big data in that situation and so increasing the depth of their answers.*

### Q2

- Expectation approach [½]
  - this involves the use of internal or external expert opinion [½]
  - and subjective judgement to specify a range of future scenarios [½]
- Extrapolation approach [½]
  - based on projecting historical trends in mortality into the future. [½]
  - This approach requires some element of subjective judgement [½]
  - e.g. the choice of period over which the trends are determined. [½]

- Explanatory, or process based, projections [½]
  - where projections attempt to model trends in mortality rates from a bio-medical perspective. [½]
  - These projections are only effective to the extent that the processes causing death are understood. [½]
  - and can be mathematically modelled [½]
- Approaches can be used in combination [½]

**[Total marks available 6, maximum 5]**

*The majority of candidates were able to identify what the question required, identifying the relevant knowledge to base their responses on and so answer this question well, with many scoring maximum marks. Some candidates however didn't recognise what was being looked for and scored poorly.*

### Q3

(i)

- Term assurance products are relatively simple products and so the company believes this approach is suitable. [½]
- The company may be looking to reduce costs... [½]
- ...to increase profits or reduce premiums which could increase sales... [½]
- ...and an online application process could reduce administration process costs... [½]
- ...or could avoid the use of intermediaries and reduce commission payments [½]
- The company may be looking to increase sales... [½]
- ...by reaching a wider network of customers, [½]
- ...as online may appeal to a different target market. [½]
- Competitors may be using online forms already so there is a need to keep up with the market to remain competitive. [½]
- It is also possible external events (e.g. a pandemic) are moving the market towards an online approach. [½]
- It may also be quicker than the current method and so be more attractive to customers [½]
- Or it may allow the company to process high volumes of applications with the same resource compared to currently [½]
- Moving from manual paper based process to online reduces scope for manual errors if proper system controls in place [½]
- There is also a social responsibility angle in reducing paper waste. [½]
- Automation may lead to a more accurate / valid / stable underwriting approach... [½]
- ...and could lead to improved reinsurance rates. [½]

**[Total marks available 8, maximum 3]**

(ii)

- There could be an unexpected change in the volume of business [½]
- The target market may change when using online applications... [½]
- ...and so demographic experience may be worse than expected... [½]
- ...hence changing mortality risk [½]
- Expenses may be higher (or lower) than expected... [½]
- ... and the company does not have experience of these yet... [½]
- ...and so increasing the potential variation in expenses against assumptions [½]
- There could be an increase in fraud risk with an online process... [½]
- ...if it is easier for policyholders to make incorrect or false statements via online underwriting [½]
- New operational risks may be introduced [½]
- ... e.g. website failure, data security breach (any suitable e.g.) [½]
- This could lead to reputational risk [½]
- In addition, there is a risk of damaging relationships with intermediaries. [½]

**[Marks available 6½, maximum 4]**

**[Total marks available 14½, maximum 7]**

*Most candidates answered part (i) well covering a number of reasons that could be motivation for the company to introduce an online process. Part (ii) was not answered as well in general with stronger candidates considering a broader range of risks, expanding on each.*

**Q4**

(i)

- It is common for life insurance policies to include options to:
  - Purchase additional benefits without providing further evidence of health; [½]
    - Benefits are purchased at the normal premium rates (for a life of that age) at the date on which the option is exercised [½]
    - Additional benefits may be limited in terms of amount [½]
    - And when they can be exercised [½]
- Renew a life insurance policy, e.g. a term assurance at the end of its original term; [½]
  - without providing additional evidence of health [½]
  - renewal may only be allowed once [½]
- Convert all or part of the sum assured from one contract to another. [½]
  - e.g. from term assurance to endowment assurance [½]
- Add a second life as a life insured [½]

- On the normal premium rates (for the sex and age of the second life) at time of option exercise [1/2]

**[Total marks available 5½, maximum 3]**

(ii)

- **Additional Benefits**

- there may have been a change in circumstances, [1]
- e.g. change of job, additional children, got married [1/2]
- Or original product may be backing a mortgage which may have changed [1/2]
- e.g. through moving house [1/2]
- and policyholder wants to take up the additional sum assured under the option [1/2]
- Alternatively, inflation may have eroded the original value of benefits over time and the policyholder wants to offset this. [1/2]

- **Renew**

- the policyholder may be in poor health [1]
- and want cover for an extra period of time [1/2]
- and costs of any new policy are higher than renewal costs [1/2]
- or unable to obtain a similar product [1/2]
- or just values the convenience of not having to shop around [1/2]
- policy may be backing a debt/mortgage [1/2]
- and term of debt/mortgage may have been extended [1/2]

- **Convert**

- policyholder may now be able to afford a savings contract (e.g. endowment) [1]
- but also wants to maintain the death cover [1/2]
- or vice versa, policyholder may now only want the death benefit rather than savings element [1/2]

- **Second life**

- Policyholder may have got married or civil partnership and so want to add second life coverage [1/2]
- Where they have a dependency on the second life and would suffer financial loss on their death [1/2]

**[Marks available 10½, maximum 5]**

**[Total marks available 16, maximum 8]**

*Part (i) was answered well with almost all candidates identifying three common options. Candidates found part (ii) more difficult with those who structured the answer by focussing on each of the mortality options and related reasons in turn scoring more highly than those who sought to cover all possible reasons without structure behind them.*

**Q5**

- Company should select investments that are appropriate to nature, term and currency of liabilities... [1/2]
- ... and also to maximise overall return [1/2]
- Extent of mismatch will depend on level of free assets [1/2]

- .. and risk appetite of company [1/2]

*Candidates who used the alternative definition were also given credit*

- *Company should aim to invest to maximise overall return on the assets* [1]
- *Subject to the risk being within the financial resources available to it* [1]

- All liabilities could have an overseas element, which should be matched by assets in the appropriate currency. [1/2]
- Collective investments (e.g. property funds) may be considered if the company wants a diversified exposure to an asset class. [1/2]
- **Expenses** are likely to be linked to inflation [1/2]
- ... and hence should be matched by index linked securities [1/2]
- For **unit linked contracts** the benefits are investment linked [1/2]
- ... and hence the company should match the investments chosen by policyholder [1/2]
- ... non linked liabilities could be matched by cash [1/2]
- ... or fixed interest securities [1/2]
- ... there may also be options / gtees on the unit-linked product which could be matched with derivatives (e.g. swaptions) [1/2]
- For **term assurances** the liabilities are likely to be fixed in money terms [1/2]
- ... and the liabilities are not likely to be large [1/2]
- May want to match with liquid assets (e.g. cash) [1/2]
- ... or fixed interest stocks [1/2]
- **Annuity portfolio** is likely to be long term [1/2]
- .. and guaranteed in money terms [1/2]
- ... although there could be some index-linked annuities [1/2]
- Best match would be fixed interest securities [1/2]
- ... or index-linked securities for index-linked annuities. [1/2]
- Annuities would typically be matched with government bonds [1/2]
- ... although corporate bonds could provide higher yields [1/2]
- ... but with higher risk of default [1/2]
- ... and higher yields may allow improved annuity rates and be more competitive, given this is a price sensitive market. [1/2]
- May want some cash for liquidity to pay annuities as they fall due [1/2]
- There may not be sufficient bonds of suitable term available in market [1/2]
- ... may use derivatives and options [1/2]
- Depending on level of free assets it is unlikely that the company would use equities or property [1/2]
- **Regulator** may restrict or control investment strategy [1/2]

- **Tax implications** may influence decision [½]

*This question was fairly well answered with the majority of candidates able to draw on the common asset matching principles and cover at least the basic points for each of the products in the question. Stronger candidates broke down the liability for the unit linked product into the two components of unit reserve and non-unit reserve and considered relevant assets for each.*

**[Total marks available 16, maximum 10]**

## Q6

(i)

- Given a choice between the future cashflows from Product A and B, economic theory states that an investor should choose the one with the higher net present value. [1]
- So Product B appears better. [½]
- This maximises the net present worth of the company. [½]
- However it is subject to the law of diminishing returns [½]
- , and it says nothing about competition. [½]
- The fact that there is no IRR on product A is likely to be due to there being no initial negative cash flow. [½]
- ... or more than one negative outflow [½]
- This may make product A more appropriate depending on the level of capital available [½]
- However, product B has a high IRR at 20% [½]
- Meaning that product B may be better if the company has enough capital. [½]
- The payback period for product B is long at 6 years. [½]
- So again the decision depends on the company's capital position [½]
- The company may prefer product A which has a shorter payback period. [½]

**[Total marks available 7, maximum 5]**

(ii)

- The company's capital position would be key in determining whether it can afford to launch the product [½]
- Especially a capital intensive product such as product B [½]
- Set up and development costs for the new product would be considered. [½]
- The cost of capital for each product would be considered [½]
- Expected new business volumes over time are key. [1]
- Even though Product B looks more profitable on a NPV basis [½]
- Product A may sell more in terms of premiums and may be more profitable overall [½]

- The company should consider the full profit profile of the products rather than just the metrics given [½]
- ... and sensitivity to the assumptions used in calculating the profit criterion [½]
- Risk profile of products... [½]
- ...and Company's Risk Appetite [½]
- The competition will be key. [½]
- Entry into the market may be difficult if there is already an established provider. [½]
- The company should consider if the new product is consistent with its other products... [½]
- ...is suitable for its intended distribution channel. [½]

**[Marks available 8, maximum 4]**

**[Total marks available 15, maximum 9]**

*This question was not particularly well answered overall. In part (i), stronger candidates considered availability of capital and law of diminishing returns when comparing the metrics but many only made basic comparisons. In part (ii) candidates who scored well identified a breadth of additional information the company may consider rather than looking to expand on a smaller range of points.*

### Q7

(i) The interests of unitholders not involved in a unit transaction should be unaffected by that transaction. [1]

**[Marks available 1, maximum 1]**

(ii)

- Existing policyholders in fund A should not be affected by the transfer, [½]
- So the price of existing units should remain unchanged at 2.25. [1]

Value of assets transferred into fund A should be determined as follows:

- |   |        |     |
|---|--------|-----|
| • Market offer price of assets                              | 50,000 | [½] |
| • + Cash on deposit   | 400    | [½] |
| • + Investments sold but not yet settled                    | 5,000  | [½] |
| • - Loans to the fund                                       | (325)  | [½] |
| • - Investments purchased but not yet settled               | (100)  | [½] |
| • + Accrued income  | 50     | [½] |
| • - Accrued tax   | (125)  | [½] |
| • Total   | 54,900 | [½] |
| • No errors in above calculation                            |        | [½] |
| • Number of new units to produce = $54,900 / 2.25 = 24,400$ |        | [1] |

**[Total marks available 7, maximum 5]**

(ii)

- The funds to be merged should have consistent investment aims, [1]
- ...and a consistent risk profile. [½]
- Whether there are any difference in charges between the two funds [1]
- Particularly if this will result in higher charges for the fund being closed and merged. [½]
- Whether this will change the future choice of bid/offer pricing basis for either fund, [½]
- And how this will affect the different groups of policyholders. [½]
- Whether the policy conditions are consistent between the two funds, e.g. in terms of [1]
  - Surrender terms [½]
  - Notice periods for policyholders [½]
- What policyholders were told in marketing or sales literature considering treating customers fairly [½]
- How the practical day-to-day aspects of the funds will be harmonised (e.g. management box, pricing timing) [½]
- Any tax implications resulting from the transfer [½]
- How the decision will be communicated to the customer [1]
- What the default approach will be for customers if they opt to take no action themselves [½]
- Whether there will be any waiver of fees for switching unit funds [½]
  - For the policyholders in the fund being closed [½]
  - Or the policyholders in the fund being merged into [½]
- Costs to the company that will arise from merging the funds [1]
- e.g. system changes [½]
- e.g. policyholder communication [½]
- When the merger should take place [½]
- Any regulatory requirements relating to the merger [½]
- How to execute the transfer of funds relating to the merger, [1]
- e.g. will the fund being closed be liquidated as cash [½]
- e.g. if not, time period over which the assets from the closed fund will be adjusted to fit the asset strategy of the new fund. [½]
- Past practice in relation to the fund or in carrying out fund mergers. [½]
- There is a risk of lapses as a result of this fund merge... [½]
- ...and reputational risk [½]

**[Marks available 17, maximum 10]**

**[Total marks available 25, maximum 16]**

*Almost all candidates were able to correctly define the basic equity principle in part (i). Part (ii) was one of the highest scoring question parts with most candidates correctly completing the calculation. Some candidates made mistakes close to the end of the calculation but where workings were clearly shown they gained marks for the correct elements of these. Part (iii) in contrast was one of the most poorly answered questions with only the strongest candidates generating the required depth and breadth of factors required to score well.*

## Q8

(i)

- The annuity will be higher when taking the option... [½]
- as interest rates will be higher... [½]
- and hence the fund can purchase a higher level of annuity than in the open market. [½]
- The option is 'in the money' given current interest rates... [½]
- .so it is financially advantageous to the policyholder to take the option [½]

**[Total marks available 2½, maximum 2]**

(ii)

- The value of these liabilities can be determined using option-pricing techniques, or [½]
- ... stochastic model for future interest rates. [½]
- Either approach will require an assumption about the number of policyholders who exercise the option... [½]
- ...and a means of determining the estimated unit-fund at retirement [½]

### Option pricing techniques

- The option is analogous to options traded in the market place. [1]
- A guaranteed annuity rate corresponds to a call option on the bonds that would be necessary to ensure the guarantee was met [½]
- i.e. at an exercise price which generates the required fixed rate of return [½]
- Alternatively, it can be mirrored by an option to swap floating rate returns at the option date for fixed rate returns sufficient to meet the guaranteed annuity option (a "swaption"). [½]

### Stochastic modelling

- The firm can model the cost of the option stochastically by considering multiple scenarios of future interest rates. [½]
- The scenarios to use could be generated by an ESG [½]
- The present value of the liability can be determined by discounting the simulated cost of exercising the option at a suitable rate. [½]

- The simulated cost is the value of guaranteed pension in excess of the open option, multiplied by the percentage assumed to take that option. [½]
- Repeated simulation will generate the probability distribution of the present value of the cost of the option [½]
- As an alternative a closed form model may be used (e.g. Black-Scholes) [½]

**[Total marks available 7½, maximum 5]**

(iii)

- Time required to develop the stochastic model ... [1]
- ...and cost of building the model, potentially utilising external expertise [½]
- Compared to the number of policies still in force [½]
- And the size of the potential reserves [1]
- The company will need to consider whether it wants a market consistent or prudent valuation... [½]
- .. if a market consistent valuation then the replicating portfolio will be required [½]
- If the reserves are material then a stochastic model may be more appropriate [½]
- Internal knowledge to develop either approach [1]
- Or whether external knowledge will be required [½]
- Whether an upper and lower limit on the reserve is appropriate, or if it needs to be more accurate [½]
- How 'in the money' the guarantee is. [½]
- ... and how this correlates to the option take up rates [½]
- If the guarantee is heavily in the money and is unlikely to become out of the money then the option is likely to be always exercised, [½]
- which means the option take up doesn't need to be modelled as accurately, and a stochastic model may not be required. [½]

**[Total marks available 8½, maximum 5]**

(iv)

- It would seem unusual not to take the guaranteed annuity when it is in the money and financially advantageous to do so [1]
- A high level of pension (e.g. possibly through a final salary scheme) may mean that the annuity from this product is not as key to the policyholders' retirement income [1]
- Whereas other professions may have a lower alternative source of retirement income ... [½]
- so this pension is valuable in retirement [½]
- and even more so when the option is in the money. [½]
- High professions may use this product for the saving element [1]
- and take the lump sum in favour of the annuity, [½]
- and use the lump sum to pay for luxury items e.g. cruise [½]
- ... or may be more confident in taking the lump sum and investing for themselves [½]
- The level of tax paid may be disadvantageous to the policyholder if they take the annuity rather than lump sum [½]

- There may be regulatory restrictions on the maximum value of pension [½]

[Marks available 7, maximum 5]

[Total marks available 25½, maximum 17]

*The question was not well answered in general. Candidates generally did better in the early parts of the question but poorly in the later parts. In part (ii) stronger candidates considered the specifics of the question when answering, especially when considering the stochastic approach. As with other questions where generation of a number of points was required, parts (iii) and (iv) differentiated between candidates with only the strongest generating a breadth of points in part (iii) and taking a logical approach to part (iv) considering from a number of angles.*

## Q9

(i)

- The company is likely to require capital to carry out its business plan [1]
- ... financing new business strain [½]
- ... and associated setup / advisor / underwriting costs [½]
- ... funding acquisitions [½]
- ... investing in infrastructure [½]
- ... e.g. IT projects [½]
- ... investing in company projects [½]
- ... e.g. development of new products [½]
- ... e.g. relocation/redundancy exercises [½]
- ... e.g. regulatory change [½]
- The company will want to hold capital to enable it to be able to withstand adverse conditions [1]
- The company may want to ensure they have enough free assets to allow investment freedom [½]
- The company is likely to be required to hold a level of capital by regulators [½]
- Capital may also be required to carry out day-to-day activities, e.g. settle tax bills [1]
- Holding capital can demonstrate financial strength, which could improve the company's credit rating. [½]

[Total marks available 9, maximum 6]

(ii)

- **General checks** needed on
- .. the model [½]
- .. the data [½]
- ... the assumptions [½]

- It should be checked all of these items used have been through the correct governance [1/2]
- The opening position should be checked to ensure it is consistent with other sources (e.g. unit-linked fund consistent with accounts) [1/2]
- Analysis of surplus by checking the sources of surplus arising, whether it is consistent each year. [1/2]
- Ratio checks such as increase in reserve over the period v/s the increase in premium, ratio of capital to reserves etc. [1/2]
- The results would be peer reviewed and checked against previous projections [1/2]
- **Model checks**
- Does the model reflect all cash flows arising from the business [1/2]
- .. including any regulatory capital requirements [1/2]
- .. it needs to allow for any interactions between assets and liabilities [1/2]
- ... and include any product options [1/2]
- The model itself can be checked by replicating an independent approximate model. [1/2]
- **Data**
- Is existing business data correct [1/2]
- ... and if model points are used they need to reflect the key risk factors that impact cashflows [1/2]
- The new business data model points need to reflect the likely business mix
- ... and volume [1/2]
- ... and are volume levels realistic or unusually low? [1/2]
- Is the asset data correct [1/2]
- ... and based on current investment holdings [1/2]
- ... and future investment strategy [1/2]
- **Assumptions**
- The assumptions should be best estimate of future outcomes [1/2]
- Do the economic assumptions reflect a best estimate of economic outlook [1/2]
- ... based on projections from government or industry bodies [1/2]
- Are the expense assumptions in line with current best estimates [1/2]
- .. and allow for inflation consistent with long term economic outlook [1/2]
- Are one off expense included for key projects [1/2]
- e.g. regulatory or IT projects [1/2]
- Are statutory liability assumptions in line with regulations [1/2]
- ... and not too imprudent (thus increasing surplus) [1/2]
- Are lapse rates appropriate based on recent experience investigations? [1/2]
- How have mortality assumptions been derived for annuities [1/2]
- .. are they in line with recent investigations [1/2]
- .. and recent industry expectations for mortality improvements [1/2]
- What assumption has been made about dividends payable to shareholders [1/2]
- .. are they in line with recent payments [1/2]

- .. or do they allow for an increase [½]

**[Total marks available 18, maximum 11]**

(iii)

- As the company is a proprietary one it may want to increase dividends [1]
- .. or pay a special dividend [½]
- The company may want to invest in company infrastructure [1]
- e.g. IT projects, or office locations [½]
- There may be a need to set aside some funds for future regulatory change [1]
- The company may want to invest in new business [1]
- ... in terms of increasing volume (e.g. lower prices) [½]
- ... or changing business mix (e.g. accepting more capital intensive) [½]
- ... or looking into new channels or products [½]
- The company may look at acquisition of another company [1]
- The company may decide to make the assumptions more prudent [½]
- .. whilst this wouldn't use the "surplus", it would mean that there is additional prudence in the projections [½]
- The company may want to look at the investment strategy [1]
- .. potentially allowing more freedom in matching of assets [½]
- ... given there is a high, and growing, level of free assets [½]
- Company may pay more incentives to employees... [½]
- ...or may wish to buy-back some of its shares. [½]
- The company may want to reduce reliance on reinsurance... [½]
- ...or reduce its level of borrowing. [½]
- The company may want to invest in corporate responsibility initiatives [½]
- Alternatively it may retain some/all of the capital to maintain financial strength [½]

**[Total marks available 13½, maximum 6]**

**[Total marks available 40½, maximum 23]**

*Answers to part (i) were poor given that the answer was founded in knowledge based fundamentals. The average score was a little over half for this question part with stronger candidates scoring well where they considered a broad range of activities that the company would require capital for. Part (ii) was not well answered in general with some candidates focussing deeply on only a few checks with a lot of granular detail surrounding the checks. Candidates who scored relatively well identified a broad range of data checks and how they would be approached at a high level. In part (iii), as with other similar question parts, stronger candidates used the specifics in the question and covered a breadth of points.*

**END OF EXAMINERS' REPORT**

