



INSTITUTE OF ACTUARIAL
& QUANTITATIVE STUDIES

Subject: Actuarial Practice 1

Chapter: Unit 4

Category: Practice questions

The university currently has 30,000 students and 5,000 employees.

The university offers its employees various benefits. These include life cover, cover for sickness and disability, as well as membership of a pension scheme. Some employees are in a defined benefit pension scheme and others in a defined contribution scheme.

The university is looking to significantly increase the number of students it has as part of its expansion plan to become a world leading university. It is considering whether to expand the current campus, open a new campus in a different city or open a new campus in a different country. It is consulting a number of different professional advisers as part of this process.

The government in Country A has recently announced legislation which will substantially increase the state pension benefits to all citizens in Country A. At the same time state pension benefits increase so will the state pension age. The net effect is expected to give rise to additional costs and tax rates in Country A are expected to rise to help fund these costs.

The university is concerned about the long-term affordability of its pension commitments and has asked your company to advise if this may be a suitable opportunity to consider closing the defined benefit scheme and also to reduce contributions to the defined contribution scheme.

Questions

- (i) Suggest why the government may have decided to increase the state pension. [4]
- (ii) Outline why the university may be concerned about its pension commitments. [3]
- (iii) Discuss the options that may be available to the university regarding its pension commitments. [8]
- (iv) Discuss the impact of the university's expansion on its stakeholders. [5]
- (v) Discuss how actuaries could contribute to the university's expansion plan. [5]
- (vi) Outline how the university could raise the capital needed for its expansion plan. [4]
- (vii) Discuss the risks involved in the expansion plan, indicating for each how that risk might be managed. [6]
- (viii) Suggest the types of insurance cover the university may need. [4]
- (ix) Outline other areas, in addition to the expansion plan, on which actuaries could provide advice to the university. [3]

Your employer has recently set up a new department dealing with 'Big data'.

- (x) Outline what is meant by 'Big data'. [2]
- (xi) Discuss the challenges involved in using 'Big data'. [3]

Q2. April 2019 – Paper 1 – Q3

Over the last five years in a particular country, the government has been reducing the amount of state healthcare it provides, while the population size has remained unchanged.

An insurance company operating in that country sells a variety of domestic products and is considering the implications of the healthcare reductions for its pricing assumptions.

Discuss the implications for the pricing assumptions of each of the company's products sold in that country:

- (a) Term assurance
- (b) Medically underwritten annuity (where the policyholder provided information on their health status at application stage)
- (c) Private medical care
- (d) Funeral cover (where the insurance company pays the funeral costs for the policyholder). [8]

Q3. April 2019 – Paper 1 – Q5

- (i) Set out specific expense loadings that need to be considered for a long-term insurance contract. [5]
- (ii) Describe how to carry out an expense analysis for the purpose of pricing a new long-term insurance contract. [5]

[Total 10]

Q4. April 2019 – Paper 1 – Q8

- (i) Explain why it is necessary to have different mortality tables for different classes of lives. [5]
- (ii) Discuss, in each of the following separate cases, the expected differences in the level of mortality:
 - (a) term assurance policyholders versus general population
 - (b) an employer's group life policy with an insurance company versus the insurance company's term assurances
 - (c) pensioners of an employer's directors' pension scheme versus pensioners of the employer's staff pension scheme. [18]
- (iii) Discuss why it is important to monitor mortality experience. Your answer should include references to the cases in part (ii). [7]

[Total 30]

An actuary working for the life insurance company is carrying out an assessment of life expectancy in Country A for the purposes of projecting future liabilities. The actuary is considering using past data from the country's statistical authority as a basis for their initial work.

Outline the factors the actuary should take into account when using this data. [6]

Q6. September 2019 – Paper 1 – Q4

Discuss why an insurance company may not pay a terminal bonus on one or more of its with-profits products. [11]

Q7. September 2019 – Paper 1 – Q8

An insurance company only writes term assurance contracts. The company has been monitoring its mortality experience for many years.

- (i) Describe the reasons for monitoring the mortality experience of these contracts. [4]

The mortality experience analysis has shown that the company has been underestimating the actual number of deaths that occurred over the last three years.

- (ii) Discuss the reasons why the mortality experience may have been heavier than expected. [7]
- (iii) Describe how the results of this analysis could be used. [3]

The company's mortality analysis team has raised concerns around selection in relation to these policies.

- (iv) Suggest possible reasons for the selection occurring in these policies. [4]

[Total 18]

Q8. April 2020 – Paper 1 – Q1

Explain the concept of mortality convergence. [2]

Q9. April 2020 – Paper 1 – Q7

A large corporation has purchased a number of companies from different sectors of the economy of the country it operates in. Each company has a defined benefit

- (ii) Describe the types of information that would be required to investigate the main factors affecting the mortality experience of a scheme. [7]

The members of a scheme are allowed to move their accrued pension benefits out of the scheme. The scheme's actuary calculates a lump sum 'Transfer Value' to be paid out by the scheme for this purpose.

- (iii) Outline the issues of using the types of information in (ii) to calculate Transfer Values for a scheme. [3]

[Total 12]

Q10. September 2020 – Paper 2 – Q2

Background

A large proprietary life insurance company writes a range of products in its home market. It has implemented the principles of treating customers fairly throughout all aspects of its business.

The company has been making losses on its portfolio of annuities in payment for the last 5 years. The Board of the company feel that a significant factor in these losses is due to poor policy data for its annuity business. The pricing actuary of the company has also expressed concerns that the rate of future improvements in longevity will be higher than was assumed in the original pricing of the existing annuity business.

The Board of the company are also under pressure from the company's shareholders to start selling new business in developing markets overseas. The Board are therefore considering a potential opportunity in a large overseas Country X. To date, the only life insurance policies that have been allowed to be sold in Country X have been through the state nationalised insurer. The state nationalised insurer offers only a very limited range of products, and significant parts of the population have not purchased any life insurance products.

Proprietary life insurance companies have just started to be allowed to compete with the state nationalised insurer. The Company is considering whether to start selling life insurance business in Country X.

The insurance regulator in Country X is considering how it might assess whether customers have been treated fairly, by surveying customers when they receive the payouts on their products, and then asking how happy the customers are with their payout.

Questions

- (iii) Discuss the advantages and disadvantages to the shareholders of the company of adopting the same approach to treating customers fairly for business written in Country X to the business written in the company's home market. [5]
- (iv) Discuss the advantages and disadvantages for the following parties if the company has a significantly weaker approach to treating customers fairly for Country X business than that taken for business written in the company's home market:
 - (a) potential consumers in Country X.
 - (b) the overseas regulator in Country X. [4]
- (v) Assess the effectiveness of the proposal by the insurance regulator in Country X to assess whether customers have been treated fairly. [9]
- (vi) Outline the main advantages, compared with a small mutual insurer, you would expect the company to have in starting to sell business in Country X. [8]
- (vii) Discuss the factors that the company should consider in deciding on the relative importance of launching overseas or improving the profitability of the annuity business. [10]

[Total 53]

Q11. September 2020 – Paper 1 – Q3

A retail bank is planning to set up a new insurance subsidiary, located in a previously unoccupied floor in the bank's head office.

Describe the types of expenses that the subsidiary would be expected to incur in its first 12 months. [8]

Q12. September 2020 – Paper 1 – Q8

- (i) Discuss the factors to be considered by an insurance company when deciding whether to use actual policy records or representative model points when using a financial model. [7]

An insurance company has recently completed a valuation of its liabilities for a particular class of business using its stochastic model. It has decided to review the accuracy of the results using actual policy records.

The company has already checked the accuracy of the data, assumptions and formulae to be used.

- (ii) Discuss the reasons why the insurance company has used a stochastic model rather than a deterministic model. [8]

Q13. April 2021 – Paper 2 – Q1**Background**

An insurance company (LifeCo) in a developed country with a high level of financial regulation is considering selling a new product providing long-term care benefits for individual citizens. LifeCo currently sells whole of life assurance and annuity products.

In recent years, the country's citizens have benefitted from significant improvements in life expectancy. Over the same period, there have been significant restrictions on government spending. This has led to the government reducing its financial support for meeting the costs of long-term care for its citizens. The government has indicated that it plans to cut its funding of long-term care further in future years.

In response to the government's proposed changes in long-term care funding, LifeCo intends launching a new long-term care product, which will be sold to people in employment. The product will offer a range of benefits that can be chosen by the individual. The benefits offered on the product may include:

- provision of nursing care in the policyholder's own home.
- cash payments to cover residential care.
- placements at purpose-built care homes, with different levels of care available depending on need.
- cover for funeral costs.

Competition for this type of product is currently very low with few competitors in the market. However, due to the reduction in government financial support for long-term care, a number of banks are also considering entering this market and offering each of the individual benefits listed above to their customers as standalone products.

Questions

- (i) List the advisers LifeCo may need to consult in setting up the new long-term care product. [3]
- (ii) Discuss the factors LifeCo should consider before deciding to launch this new product. [10]
- (iii) Describe the roles that the regulatory authorities may have in respect of the launch and ongoing management of LifeCo's new product. [5]
- (iv) Discuss the risks that LifeCo faces from other parties that could affect the success of LifeCo's new product. [8]
- (v) Discuss how LifeCo could mitigate the risks identified in part (iv). [6]
- (vi) Discuss the level and cover of benefits that LifeCo could offer to policyholders who have stopped paying premiums. [4]

Q14. April 2021 – Paper 1 – Q4

A life insurance company currently offers its with-profits policyholders the option of surrendering their policy early. On surrender, the policyholder is paid a surrender value, the amount of which is at the discretion of the company. Historically, surrender values paid in the early years of a policy have been significantly lower than the expected value of the policy at maturity, even after adjusting for future premiums and investment returns.

- (i) Outline the reasons why the life insurance company would take the approach outlined above to determine surrender values. [2]
- (ii) Suggest possible reasons why a policyholder would want to surrender the policy in the early years. [2]

Following complaints from surrendering policyholders, the insurance company plans to review its approach to determining surrender values.

- (iii) Suggest possible factors the insurance company should consider in its review. [4]

[Total 8]

Q15. April 2021 – Paper 1 – Q9

A football club has a defined benefit pension scheme for its employees. It has three different categories of employee who work for the club.

- Players – generally paid between £500,000 and £1,000,000 p.a. At this particular club, they are very loyal and play for the club between the ages of 18 and 35, at which point they retire.
- One manager – the club has employed five managers over the last 60 years; the current manager is paid £250,000 p.a.
- Staff – the remaining 100 staff members have worked for the club for an average of 30 years, with an average salary of £40,000 p.a.

- (i) Outline the possible issues the football club would have considered in designing the benefits for each category of employee. [7]
- (ii) Explain why different mortality assumptions may need to be used for each category of employee. [5]
- (iii) Discuss how the scheme's managers could control the different expenses associated with running the pension scheme. [5]
- (iv) Suggest, with reasons, an appropriate investment strategy for the scheme. [7]

Q16. September 2021 – Paper 2 – Q1**Background**

XYZ is an insurance company that sponsors a large defined benefit pension scheme and has decided to embark on a modernisation programme. The aim of the programme is to:

- improve profitability, which will be used to reduce the deficit in the pension scheme.
- reduce the running costs of the pension scheme that will also reduce the deficit.

XYZ has proposed two options to improve profitability of the business:

- Option A

All of XYZ's products will only be available to buy over the internet through its own website and not via brokers. Information will be provided to price comparison websites, which will be paid a fixed fee for each policy purchased.

- Option B

Launch a new car insurance policy that will require each policyholder to install a 'black box' recorder in their car. The black box will record the distance and speed travelled and will be relayed back to XYZ once a day.

In addition, XYZ has proposed the following ideas to reduce the expenses of running the pension scheme:

- The scheme offers members the option of transferring the value of their benefits to another pension arrangement. Members will obtain transfer value quotations online, which will be calculated using a single factor regardless of age, gender or pension size. If a member accepts the quotation, the transfer value will be processed automatically online. The aim would be to reduce the number of members of staff running the pension scheme.
- The pension scheme has sold all of its assets and re-invested in one fund run by one investment manager that invests only in investment grade corporate bonds on an active basis. The value of these assets will be available daily from the internet, enabling calculation of the assets in any valuation simpler.

Questions

- (i) Discuss the reasons why XYZ would sell its products over the internet, rather than through a broker. [4]
- (ii) Describe the problems associated with lack of data that XYZ may encounter before the launch of the car insurance policy under Option B. [4]
- (iii) Discuss how XYZ may overcome the lack of data associated with the car insurance policy. [3]

- (vi) List, with examples, the types of expenses that the pension scheme needs to manage. [3]
- (vii) Discuss how the pension scheme will set the assumptions for the transfer value factor. [6]
- (viii) Outline the issues of having only one factor for transfer values. [5]
- (ix) Discuss the risks that arise from investing all of the scheme's assets in a single managed fund. [5]

[Total 46]

Q17. September 2021 – Paper 2 – Q1

Background

An actuary has been providing advice to the State Health Service (HS) of a particular country. HS provides health services to all citizens of the country and is in a permanent situation whereby demand for its services exceeds supply. HS is funded by the country's government on a pay-as-you-go basis.

HS is becoming increasingly concerned about the cost of sickness benefits paid to its employees whenever they are sick and unable to perform their usual jobs for HS. HS pays employees 80% of their usual salary while they are sick and are unable to work, for all periods of sickness. They have asked for the actuary's advice on how sickness costs may be controlled, while ensuring HS remains operationally effective.

Two initial proposals being considered are:

- Option A – to place a cap on the maximum number of days of sickness pay for an employee.
- Option B – insure the sickness benefits.

As a separate project, HS is planning to run a trial in one hospital to examine the potential benefit arising from improving the nutritional intake of in-patients. HS has asked the actuary to advise on how the trial hospital may be chosen, how the success of the trial may be measured and how to introduce any successful outcomes across hospitals nationally.

An insurance company is considering offering a care product. In return for regular premiums, the insurer would provide limited care of minor ailments from private hospitals that are not linked to HS.

Questions

- (i) List the main contingencies that would drive the costs of the sickness scheme. [4]

- (iv) Discuss the likely effectiveness of Option B for controlling costs for the sickness scheme, while ensuring HS remains operationally effective. [4]
- (v) Discuss other methods of controlling the costs of the sickness scheme. [10]
- (vi) Outline criteria that could be used for selecting the trial hospital. [5]
- (vii) Discuss how the success of the trial project could be measured. [5]
- (viii) Outline how stakeholders other than HS may be affected if the trial project is a success. [5]
- (ix) Discuss the possible impacts on HS from the insurer's health and care product. [7]

[Total 54]

Q18. September 2021 – Paper 1 – Q2

A company wishes to appoint an actuary to provide advice on setting up a new retirement benefit scheme for its employees. Due to a global pandemic, face-to-face meetings are no longer permitted due to the risk of infection.

- (i) Outline the information that the actuary should gather prior to accepting the appointment. [3]
- (ii) Outline the difficulties the actuary may face as a result of the limitations on face-to-face meetings, while determining whether to accept the appointment. [2]

[Total 5]

Q19. September 2021 – Paper 1 – Q3

An individual is considering starting a business that will involve caring for young children while the children's parents or guardians are at work. The business will be required to meet childcare standards set by the government.

List the various items of cashflow that would need to be allowed for by a model that aims to assess the potential profitability of this business. [6]

Q20. September 2021 – Paper 1 – Q11

An insurance company has decided to replace its existing deterministic pricing, valuation and financial planning models with stochastic models.

- (i) Discuss why an insurance company may decide to use a stochastic model. [3]

loss on this business. [7]

- (iii) Discuss how different stakeholders could be affected by the company making losses. [5]

[Total 15]

Q21. April 2022 – Paper 1 – Q4

The managers of a large defined benefit pension scheme, which now consists solely of members with pensions in payment, have appointed an actuary to monitor the scheme's mortality experience.

- (i) Outline reasons why the scheme's mortality experience should be monitored. [4]
- (ii) Describe the data the actuary would require to undertake the monitoring. [5]

[Total 9]

Q22. April 2022 – Paper 1 – Q7

An actuary has been asked to price a new financial product for an insurance company, using a deterministic model. One of the assumptions in the pricing model is extremely uncertain.

Discuss how the actuary could approach setting this assumption. [13]

Q23. September 2022 – Paper 1 – Q5

An insurance company has just reviewed its pricing assumptions. Following the review, the company revised the annual renewal expense pricing assumption on one of its products to £60 per policy. The average annual renewal expense for this product over recent years has been £85 per policy.

Discuss possible reasons why the annual renewal expense assumption has been set to be less than the average annual renewal expense over recent years. [7]

Q24. September 2022 – Paper 1 – Q6

An insurance company uses financial derivatives to manage its exposure to options and guarantees across a range of financial products it has sold to investors. The range of financial products includes ones that pay benefits on death, on surrender and on maturity.

[Total 7]

Q25. September 2022 – Paper 1 – Q9

An established life assurance company has been selling term assurance for some years and is about to start selling a new term assurance product.

The new product will be sold to people whose lifestyle and fitness will be monitored by them wearing a wristband.

The wristband collects data that will be shared with the insurance company.

Policyholders will then be offered various benefits and rewards from the insurance company depending on the data collected from them.

- (i) Discuss the additional data governance issues that may arise from this new product compared to the existing term assurance business. [6]
- (ii) Outline the main limitations of the wristband data as a means of determining the level of benefits and reward to be given to a policyholder. [3]

[Total 9]

Q26. September 2022 – Paper 1 – Q10

An insurance company is investigating replacing its existing method for pricing its car rental insurance policies with a more sophisticated approach. It is planning to use publicly and commercially available data as a starting point for pricing these policies.

- (i) Suggest the types of publicly and commercially available data that the insurance company could use. [2]
- (ii) Discuss why the new data may be an improvement on the existing method used to price for risk. [3]
- (iii) Outline the problems that may be involved in using this new data. [3]
- (iv) Discuss how suitable this new data would be for pricing its other motor insurance policies. [5]

[Total 13]

Q27. April 2023 – Paper 1 – Q1

Describe how an insurance company will express the different types of expenses it will include when pricing a home insurance protection product. [5]

into a competition to win a car.

- (i) Describe possible issues an insurance company should consider when asking applicants about their personal data. [3]
- (ii) Outline what would be included in the company's data governance policy that could resolve the issues in part (i). [3]

[Total 6]

Q29. April 2023 – Paper 1 – Q4

Following a recent worldwide pandemic, a developed country's government wants to investigate the impact that the pandemic has had on the mortality experience of its public sector pension liabilities.

Discuss how the government can investigate the pandemic's impact on the mortality experience of its public sector pension liabilities. [7]

Q30. April 2023 – Paper 1 – Q10

A life assurance company sells a wide range of immediate annuities, including impaired life annuities. Lives in poor health are able to apply for an impaired life annuity. One of the rating factors used is the postal code (also known as the zip code) of the annuitant.

- (i) Describe why the company will use homogeneous groups when pricing its annuities. [5]
- (ii) Outline the reasons why an individual may seek to purchase an immediate annuity. [3]
- (iii) Suggest, with reasons, the main types of life who are likely to be priced on an individual basis. [2]
- (iv) Discuss how useful the postal code may be as a means of understanding some of the principal factors that contribute to the variation in mortality of the non-impaired annuitants. [6]
- (v) Outline the possible types of selection among the non-impaired annuity lives. [5]

[Total 21]