

Actuarial Society of South Africa

MARKING SCHEDULE

October 2022

Subject F205 - Investment

Fellowship Applications

The paper was written in online format, using a platform provided by ASSA. The exam setting and marking process was undertaken as normal. Some candidates struggled to upload their solutions but this issue was resolved.

The paper comprised four questions in the standard format. The paper, once again, favoured a number of shorter sub-questions with smaller mark allocations. Question 1 covered share price analysis and evaluating unit trusts for an individual investor. Question 2 dealt with the implications of the Regulation 28 increase in offshore investment exposure limits for pension funds. Question 3 explored digital financial advice considerations as well as the valuation of a financial advisory business. Question 4 was a more technical question that covered illiquidity premium and asset liability modelling considerations for guaranteed life annuity contracts.

The exam covered a number of important investment concepts and required candidates to use their solid knowledge of the theory and current industry developments to solve practical challenges affecting investment actuaries and their clients.

Some very well answered scripts were received, with a further three papers in the region of the pass mark. The average mark for this exam was slightly higher than previous sessions. The overall result was that 24% of candidates passed and all but one of the candidates scored at least FB.

Please note that this examiner report presents one possible model solution to the questions. Alternative solutions provided are considered and marks awarded where correct points are well motivated.

QUESTION 1

Examiner Comments:

Question 1 tested candidates' understanding of share portfolios and general equity unit trusts including the process of evaluating and selecting unit trusts.

Part (i) was pure bookwork and tested understanding of distributions and shares going ex-div. Given that this is a basic concept in share investing, the results were surprisingly poor.

Part (ii) required candidates to compare two unit trusts in the general equity category and part (iii) asked about the additional information to request from unit trust providers in order to make a recommendation to a client. Question (ii) was reasonably well answered with candidates demonstrating decent knowledge of this fundamental investment vehicle. Question (iii) was not as well answered – candidates were not able to identify the full set of considerations in selecting asset managers, which is important in both the retirement fund and retail environment.

Part (iv) rounded off the question by asking about the implications of a switch from a share portfolio to an equity unit trust. Most candidates had a fair grasp of the differences and hence the important considerations and impacts.

i. a.

Reasons for fall:

- XCo share went ex div as at yesterday's close.
- Value of distribution per 100 shares of XCo is $R181.50 \times 4.47 = R811.31$
- Value of distribution as % of value of XCo shares = $R811.31 / R3,150 = 25.8\%$
- So the expected fall in price of XCo shares (all else equal) is 25.8%, which implies an expected opening price today of R23.39
- The fall of only 24% to R23.94 means that XCo share price is effectively up 2.4% today.
- This share price strength today may be artificial as bargain hunters (particularly some retail investors who haven't noted the distribution) think the share is offering significant value after dropping so much.

b.

Key points to assess buy / sell / hold decision:

- The relative valuations of XCo and YCo post unbundling
- The reason for the distribution was most likely to simplify the structure and address shareholder preferences for a clean choice of owning one business or the other rather than being forced to own a business they don't want. This may lead to renewed interest in the share and hence upward revision in share price – some may even sell their newly-allocated YCo shares and top up on XCo shares.
- It does not look like a serious buying opportunity unless there is other information not mentioned in the question.
- However, there is no cause for concern as the decline in share price is not a loss and is not a reflection of any issues at the business.
- Client's share account will reflect the shares in YCo – may not reflect immediately due to system updates required.

- It is possible that the arrangement may include an odd lot offer – shareholders who hold only a few XCo shares and thus qualify for a very small number of YCo shares may not receive the YCo shares but will get the equivalent value paid into their share account in cash.
- There may be an overhang in YCo shares as investors who received the distribution but who don't want to hold these shares look to sell. So expect some short term pressure on YCo share price – no cause for panic in longer term though.

ii.

Key features:

- Different benchmarks:
 - Fund A is a market cap index; Fund B is a peer-relative benchmark – this is likely to result in different focus and management of the portfolios.
- Fees:
 - Fund A fee is high for a fund that is effectively a low conviction relative approach akin to a tracker fund, a fund with such low tracking error and close alignment to the index should be priced like a tracker i.e. about half this fee;
 - Fund B has a combination of a fair, competitive active fee of 1% plus performance fees so seems appropriate for the type of fund with this level of active management and track record, total fee will be higher over time.
- Performance fees:
 - Fund A has no performance fees, which is not unusual for a fund whose approach seems to be based on a low tracking error with performance generally close to the benchmark;
 - Fund B has a more active approach and generates more alpha so performance fees are more substantial but are likely to be justified by the outperformance. There may be a timing difference i.e. the investors who earn the excellent returns aren't always the same investors who pay the performance fees, depending on when and how performance fees are crystalized. The terms and structure of the performance fees are not clear from this summary but the quantum and performance conditions would be important to understand. Structure of performance fee may lead to manager taking higher risks or targeting higher volatility.
- Transaction costs and turnover:
 - Fund A seems to have lower turnover as the transaction costs are lower, seems consistent with tracking a market cap index fairly closely i.e. not a very active approach;
 - Fund B has higher turnover, consistent with a more active approach and higher tracking error.
- Tracking error:
 - Fund A is more of a benchmark-cognizant manager; Fund B pays less attention to the benchmark (peer benchmark does imply less focus on being overweight or underweight relative to an index).
- Length of track record:
 - Fund A has a longer track record of matching the index quite closely after fees; Fund B has a shorter track record (between 5 and 10 years) of adding significant alpha.
- Quality of track record:
 - Past performance is not the only consideration but it does provide an indication of skill, particularly over the longer term.
 - Fund A has tracked the index very closely, with slight underperformance after fees over the longer term (10 years); Fund B has a very strong record of generating alpha but at quite high levels of volatility.

- Size of AUM:
 - A is a large manager with a large portfolio in SA equities, probably likely to be less nimble and access to smaller shares on JSE will be more difficult without taking a substantial position and then also introducing liquidity challenges;
 - B has smaller AUM so able to switch positions more easily and hence react quickly to new information – this can be an advantage, but not necessarily.
- Specialist niche manager vs comprehensive asset management suite:
 - Fund A is a substantial manager, probably with full suite of products and capabilities, teams may benefit from variety of skills e.g. credit analyst may have insights on corporate debt and impact on profitability;
 - Fund B effectively has only one mandate with specialist SA equity capability and limited other assets.
- Business risk:
 - A is a large manager, connected to a life assurance company so is likely to be more stable with lower business risk;
 - B is a small, niche manager with a single capability in SA equities meaning that business risk is high and this may at times overwhelm investment focus, particularly in the event that performance dips and clients leave.
- Concentration:
 - Fund A has lower concentration in its top 10 holdings, roughly in line with the top 10 holdings in the index, aligned to low conviction active manager;
 - Fund B has higher concentration in key stock positions – indicative of higher conviction but potentially higher volatility, this percentage is likely to change over time linked to their active, non-benchmark cognizant approach.
- Culture:
 - A is a large asset manager within a life company, the life company assets probably dominate and third party assets might be quite small, mostly salaried employees with limited alignment to clients in terms of incentives, possibly limited or no ownership, asset gathering probably more important than pure investment decisions;
 - Fund B is owner-managed business, smaller team, higher probability of achieving alignment of staff to client objectives and investment-oriented culture and focus.
- Volatility and drawdown:
 - Fund B has significantly higher volatility and a slightly higher drawdown, which would indicate that returns fluctuate more on a monthly basis relative to Fund A.
- Key-person risk:
 - Higher in unit trust B, which has two founders, one of whom is portfolio manager;
 - In unit trust A the team is larger so any one individual carries lower responsibilities and hence risk.
- Decision-making accountability:
 - Fund A makes decisions via committee, which can result in compromise and hence diluted decisions but allows for diversity of opinions, limits human biases and errors;
 - Fund B has single accountability, which introduces greater conviction but also means more risk if human biases override clear decision-making.

iii.

Information to be requested:

Qualitative

- Company details – ownership structure, stability, any negative press; to assess incentive structure and any conflicts
- People – key decision-makers, changes in key decision-makers over last 5 years; to assess skills and experience and team changes to assess repeatability of track record
- Investment philosophy and style – understand the manager's style; to understand likely future performance trends and ensure alignment with investor's beliefs
- Details of investment process; to understand quality and repeatability of the process:
 - Research method
 - Stock selection process – fundamental, technical, quantitative
 - Systems or research tools utilised – proprietary or third party
- Administration – details of processes and systems, any outsourced service providers; to assess robustness of the business and identify any operational risks
- Details of custodian / trustees; to check reputable outsourced providers
- Remuneration of investment professionals (portfolio managers and analysts); to check alignment with client outcomes
- Any conflicts of interest that might exist; to avoid any reasons to deviate from pure investment-driven decisions
- Mandate / supplemental deed; to check nature of portfolio and any restrictions, any allowance for inclusion of offshore shares
- Incorporation of ESG into stock picking decisions

Quantitative

- Monthly return series for longest common period – at least five years, also monthly benchmark returns for same period; to perform more detailed evaluation of performance
- Monthly return series for all funds in the SA General Equity sector for same period as above – available from Morningstar; to assess performance and other metrics against peers
- Details of performance fee – structure and terms and conditions including hurdle, high water mark, sharing rate / percentage, time period of measurement, caps, crystallization period / frequency; to evaluate fairness and value for money of the performance fees being charged
- Current holdings; to check diversification, concentration risk, unusual stocks
- Turnover stats; to check for excessive turnover
- Changes in assets – manager and portfolio; to understand shifts in the business, business risks and sustainability
- Latest fact sheets; for any other useful information
- Details of calculation of B's benchmark?

iv.

- Tax implications:
 - CGT will be payable on realised gains – will also depend on length of holding period – if less than 3 years then possible income tax.
 - CGT – triggered on sale of shares but only on sale of units in unit trust i.e. not on sale of shares by portfolio manager.
- Transaction costs – to liquidate portfolio
- Fees – the fees applicable to a personal share portfolio will depend on the type of account and mandate with the stockbroker

- Level of decision-making and control will be much less – no input on stock decisions as these will be taken by portfolio manager
- Level of client sophistication and financial acumen – favour unit trust if low financial acumen
- Specific stock preferences e.g. application of personal ESG preferences or principles will not be possible
- Diversification – depending on the size of portfolio and number of stocks held, the unit trust may provide better diversification
- Client needs – this is not specified in the question but the client needs will be important in assessing whether the share portfolio or the unit trust suits their needs better.
 - As an example, if the client needs dividends to provide an income in retirement i.e. currently retired, then the flow might be variable in share portfolio vs half yearly distributions (most likely) in a unit trust. Which is more suitable for client's needs?
- Reporting – reporting may be different – unit trust may be simpler (fact sheets) but less detailed.

[Total 30]

QUESTION 2

Examiner Comments:

Question 2 tested candidates' understanding of a very topical issue affecting retirement funds, asset consultants and asset managers in South Africa currently, namely the increase in offshore allowance within Regulation 28.

Part (i) quizzed candidates on the low allocations to the rest of Africa under the previous offshore limits, despite the quite generous limit of 10%. This was a well-answered question.

Part (ii) dealt with the increased limit and the important investment considerations. Part (iii) considered the same issue from a different angle, being the implications for the asset manager's business. This is an important change that trustees and their investment advisors and asset managers are grappling with at the moment so it was surprising that the results for both parts (ii) and (iii) were poor.

i.

- Limited opportunities in listed markets – many African countries have poorly developed stock markets with limited numbers of shares. Some, like Zimbabwe and Namibia, have stocks that are dual-listed on JSE.
- The shares that are available tend to be narrow sectors e.g. banking
- Liquidity constraints – trade is fairly low so liquidity, even on listed markets, can be a challenge.
- Difficulty repatriating funds.
- Bond markets tend to be small, shallow and illiquid with higher counterparty risk requiring careful credit analysis.
- Rest of Africa is not a homogenous area, each country has its own features, regulations, language and risks so to cover the area adequately requires more work. These factors make exposure expensive to obtain, which thus pushes up the costs of the overall portfolio.
- Emerging market with similar sectors, companies, return drivers to South Africa so limited opportunity to diversify.
- Higher regulatory risks e.g. interference in companies by regulators or revenue authorities like happened to MTN in Nigeria.
- Higher geopolitical risk and less certainty over property rights.
- Currency volatility and limited ability to hedge this.
- Some SA companies already have some exposure to Africa so additional exposure not necessary given risks.

ii.

- A fund's asset allocation is set with the aim of achieving a particular return/risk outcome. This remains the primary consideration when setting asset allocation.
- But this asset allocation is limited to within the regulatory (Reg 28) constraints
 - The fund's current 29% exposure hints that an unconstrained asset allocation might have a higher offshore allocation
- In isolation: a higher offshore allowance is good for funds as it broadens the investible universe and brings access to assets not available in SA:
 - SA contribution to global GDP is less than 1% so makes sense that majority of investment opportunities in the world lie outside South Africa

- Potential for higher returns: greater GDP growth in other geographies relative to the sub-2% expected GDP growth for South Africa should deliver better return opportunities for growth assets over time
 - Increased diversification and therefore better risk-adjusted return
- Need to consider whether adding additional offshore exposure to retirement funds helps achieve the required return with lower risk (this is a desirable outcome)
- Key consideration is the expectations for:
 - Expected asset class returns (SA equities, SA bonds, SA cash, global equities, global bonds...)
 - Volatility/correlations of these asset classes
- Previously, many funds held predominantly offshore equity because 30% was limiting and fixed interest asset classes were unappealing. But the higher limit means a more diversified approach is required for offshore i.e. additional asset classes need to be considered and included.
- Global vs regional mandates – with associated implications e.g. who does country allocation if regional?
- Increased offshore exposure results in greater exchange rate risk (vs ZAR)
 - While rand is a very liquid emerging market currency, it is also very volatile (with periods of extremely high rand volatility also coinciding with spike in market volatility)
 - Adding exchange rate exposure to a portfolio improves the risk adjusted return of the portfolio but only up to a point, after which, additional exchange rate exposure results in poorer long-term risk/return outcome
 - Fund members have ZAR-denominated liabilities, so this mismatch needs to be considered if offshore exposure increased
 - Greater consideration needs to be given to the tool of currency hedging (using currency futures/forwards) i.e. treating forex as a separate asset class. In other words: separating the asset allocation and currency allocation decisions
 - The counter argument is that pension fund savers have a very long-term investment horizon (even longer when considering post-retirement investment options like living annuities that would invest in similar assets) so the increased volatility is not that an important concern
- But offshore exposure can provide protection against a falling currency – particularly relevant for emerging markets.
- Local equity portfolios already have a high degree of rand-hedged shares and/or offshore listed companies in them. This must be taken into account when considering additional exposure
- Asset manager skill
 - As the fund's investments tilt further offshore, do the current investment managers have the relevant skill set to allocate this capital outside of South Africa?
 - Does the fund and/or its managers have the skills to manage exchange rate risks and currency hedging?
- Additional costs in terms of higher fees paid for additional research, expert advice (prior point), as well as potentially higher administration costs
- Most pension fund members individually would have a very high concentration to South Africa e.g. own a house in SA, have a job in SA so increased diversification offshore within their retirement savings might not be inappropriate
- Social considerations
 - How would investing a greater proportion of the fund offshore relate to the fund's ESG policy?

- Offshore assets might offer greater options in terms of sustainable and ESG friendly investment options
- How would pension fund members feel about investing more of their savings offshore when South Africa requires significant investment to grow its economy (especially in terms of infrastructure)?
- Double taxation agreements

iii.

- Many SA asset managers outsource the management of the foreign part of their portfolios to external 3rd party firms. This means the SA asset managers earn no, or a lower, margin on these assets. Were the foreign allocation in their portfolios to rise to 45%, this might have a detrimental impact on revenue and profitability.
- This introduces potential conflict of interest. If the SA managers choose not to utilise the full 45% offshore allowance: is this because it's best for clients or best for the asset manager's owners/staff?
- The costs associated with managing and administering offshore assets across many jurisdictions (structures, custodians, research etc) are higher so a higher allocation to offshore may push up the overall portfolio fee, with associated challenges of competitiveness especially in light of the existing pressure on fees.
- Competitive risks – losing assets if clients select managers who do implement the changes effectively or clients invest directly offshore bypassing local asset managers.
- Requirement to build offshore capability if the manager doesn't already have it:
 - With limited skills in SA this might be expensive.
 - Is it possible to compete on an active basis with global managers?
 - Offshore investment universe is exponentially larger than SA. How to decide which asset classes/geographies/sectors to cover
- Or maybe partner with an offshore business? Again economics likely to be poorer than status quo.
- If ETFs were used before, as was the case for some managers, then does a higher allocation to passive threaten the offering to clients, or maybe the ability to justify the active fees charged?

[Total 20]

QUESTION 3

Examiner Comments:

Question 3 tackled investments from a slightly different angle and one that is likely to become even more relevant in future – robo advice.

Part (i) was an easy one on investment advice and client needs. Candidates scored high marks on this question.

Part (ii) dealt with the construction of the algorithm for the robo advice tool. The question demanded a clear and organised approach. Candidates had a fair grasp of the issue but many missed out on some of the key factors.

Part (iii) asked candidates to compare robo advice to traditional face-to-face advice. The marks were not as good as we would have expected.

Part (iv) tested the important concept of how to place a value on a business, with the added angle of being a financial advisory business. Most candidates demonstrated good knowledge of valuation methodology but could have scored more marks by thinking about the practicalities and specifics of a financial advisory business.

i.

- Age
- Occupation
- Monthly income and expenditure
- Existing investments (retirement fund/unit trusts/shares)
- Existing debt
- Investing goals / objectives (retirement/new car/children's education/emergency needs, liquidity needs)
- Level of financial sophistication
- Investment time horizon
- Risk tolerance – for volatility or capital loss
- Details of any dependants and expected length of time of dependency
- Restrictions e.g. Shari'ah

ii.

The algorithm/process needs to determine:

- Time horizon of investment (e.g. next year's holiday or multiple decades hence for retirement)
 - If retirement, then age of client is relevant
 - Liquidity needs i.e. need for earlier cash flows / withdrawals
- Income less expenses – to determine disposable income and hence investable amounts to fund the savings
- The risk associated with earning the return required to achieve the goals
- User risk capacity (extent to which the future may be less favourable than was predicted without user's financial plan being derailed)
- This can then be used to set the asset allocation
 - Long duration goals like retirement can allow investment in more volatile but real assets like equities

- Shorter duration goals (like holidays) should avoid volatility and favour cash/bonds
- Currency of liability e.g. saving for overseas holiday
- Nature of liability i.e. fixed in nominal terms or real (e.g. saving for retirement)
- Expected returns, volatilities, correlations for the various asset classes (i.e. SA equity, global equity, SA bonds...) – to determine optimum asset allocation for the client and then match this asset allocation to the closest available portfolio
- Asset class restrictions e.g. if a retirement product then Reg 28 limits apply, if discretionary savings (like for holiday) then this restriction does not apply
- Annuity rates and type for retirement
- Tax considerations: high income earners might prefer tax wrappers like endowments

iii.

Advantages:

- Lower cost to client
- Lower investment minimums thereby widening the net of accessibility of advice and range of possible investments
- Easier to use and available 24/7
- Scalable
- Faster decision making
- Allows users to create investment portfolios for single goals (e.g. providing for a child's tertiary education)
- Emotion is taken out of decision-making process
- Often employs a passive strategy (pro or con)
- Often employs automatic rebalancing

Disadvantages:

- Limited scope for flexibility and personalisation
- Providers of automated advice typically try to keep the process as brief as possible, while human advisors in an interaction with clients have the advantage of being able to ask as many questions as it takes to get a good grasp of what investments a client needs
- The quicker the question stage is (less data collected) the less accurate the advice might be leading to potential poor outcomes
- If a user has a unique situation that does not come up during the initial question phase, it will not be considered by the algorithm, same applies to very complex financial situations
- Automated advisors are not capable of analysing a user's existing investments and adjusting any new investments to complement the existing portfolio to ensure diversification
- Determining a client's risk tolerance and risk capacity is more difficult without a detailed face to face discussion
- Onus on client to ensure information is accurate, but they may not understand how information is used
- No-one to manage emotions (if markets drop sharply, investors might be tempted to sell at wrong time)
- Not all clients are comfortable with technology and value the human touch but reverse also true

- Might not include or identify important aspects of ancillary advice like tax and estate planning, risk cover, wills – some robot systems do have links to other products and solutions.

iv.

- DCF (income less expenditure projected and then discounted...) considering:
- Number of clients
 - And how this has changed over the last 5 years. Is the practice growing or shrinking. If shrinking why? If growing one would be prepared to pay a premium
- Size of funds under management per client
 - Split between RA/living annuities/discretionary investments
- Average age of client (if very old, the income stream might not last long)
- Assumption about how many clients will opt to find another advisor once Brad retires (strength of relationships, can't force clients to stay)
- Assumption of client churn (how many clients leave each year) going forward
- What is Brad's charging structure:
 - Size of upfront fee (ad-valorem or hourly charge)
 - Size of ongoing fee (ad-valorem or hourly charge)
 - Is this market related? Risk of having to lower fees or option of raising fees?
- Revenue mix:
 - Upfront vs ongoing fees
 - Any other income
 - Scope to expand service or product offering beyond current
- Client service model: how time intensive will servicing the clients be? Will you be able to cope with the extended size of client base? Have to employ additional staff?
- How to handle new business in the valuation:
 - New flows from existing clients
 - New clients joining as a result of Brad's good name
- Buying the book of clients only? Or taking on the business as a going concern including all assets and liabilities like bank loans, office lease, employee obligations etc
- Possibility of taking out existing costs in Brad's business (e.g. office costs, staff costs as you already have an office and staff etc)
- Additional costs e.g. what would the increase in professional indemnity insurance be upon buying Brad's practice? Any history of PI claims including any unsettled claims or disputed claims. IT and system costs. FAIS and other regulatory compliance costs
- What discount rate to use to PV the cash flows? Given uncertainty would need to use risk free rate plus high risk premium
- Will Brad consider an earn-out with profitability targets? This will lower the risk to the purchaser. Transition period during which Brad supports purchaser and works part-time in the business and aids the transition? Will Brad agree to a non-compete agreement?
- Competitors – quality of competitors, uniqueness of offering
- Access to proprietary systems, processes, tools
- Tax implications: assessed losses or back taxes owed?
- Reasonability test:
 - What multiple of annual earnings does the DCF value represent? Is this market related?

- What % of funds under management does it represent? Is this market related?

[Total 27]

QUESTION 4

Examiner Comments:

Question 4 was a more technical actuarial question focused on an annuity book of a life insurer and the associated investment strategy. The question explored the concept of an illiquidity premium and how it could be exploited in the investment strategy. It also tested asset liability modelling methods.

Part (i) was basically a bookwork question. Scores were generally good.

Part (ii) asked for a definition of illiquidity premium and how it might apply in this case. Candidates answered this reasonably well.

Part (iii) covered the objectives of asset liability modelling and part (iv) required a comparison of deterministic and stochastic methods as well as their suitability for this purpose. Candidates did not have a good grasp of asset liability modelling so marks were generally low. Part (v) asked for a discussion on the assets and liabilities to be used as inputs in the asset liability modelling. The question elicited poor responses.

i.

- The (net of reinsurance) annuity liabilities are usually closely matched using a portfolio of fixed rate (nominal) bonds whose pay-outs (maturity value and coupons) are matched to the cash flow profile of the annuities -
 - generally called a liability driven investment (LDI) strategy.
- Usually mostly government bonds.
- Corporate credit may also be used to match liabilities as well as enhance returns, but usually only senior debt. This is more likely to be used for cash flow matching given lack of government bonds available at all required durations.
- In addition to the bonds, or as an alternative, a combination of floating for fixed rate swaps and floating rate instruments may be used.
- On short end, will include cash / money market instruments.
- Whilst shares and direct property are not good matches for the annuity liabilities, small amounts of them could be used to enhance the returns and for the very long duration liabilities (that may exceed the longest term of available bonds).
- The lower the level of free capital of the insurer the more tightly matched the investment strategy would typically be.

ii.

The illiquidity premium is any additional return received to compensate the investor for the risk of tying up capital in a less liquid asset, where it is more difficult to find a buyer should the security need to be sold quickly and/or before its maturity (if a bond).

Returns could be enhanced by taking advantage of the illiquidity premium and investing in:

- Unlisted bonds.
- Some listed bonds are relatively illiquid, and the potential for selling them is not as good as the large listed bond counters, but not as bad as that for unlisted bonds; they may have an illiquidity premium.
- If the insurer has used floating for fixed swaps to match the liability profile the floating rate instruments held may be unlisted.

- Whilst these assets would usually only ever form a tiny part of an annuity portfolio, unlisted shares and property could also contain an illiquidity risk premium.

iii.

The **objectives** of the modelling are to determine which asset portfolio:

- Minimises the probability of running into liquidity problems.
 - There would need to be sufficient liquidity generated to meet the pay-out profile of the annuities, and variability in the pay-out profile:
 - The extent to which the variability is required to be covered in excess of the expected pay-out profile would depend on the risk appetite of the insurer, the magnitude of the illiquidity premium and the availability of other liquid assets on the insurer's balance sheet to be used in an illiquidity crisis.
 - Based on the factors discussed above this may be expressed as a percentage chance, e.g. the probability of running into liquidity problems over the next 20 years, should be less than 1%.
- Maximises the surplus, which could be expressed as the difference between the value of the assets and the value of the liabilities.
 - The surplus could be measured at a specified date or dates in the future.
 - A method of valuing the assets and the liabilities will be required.
 - These methods should be consistent with each other.
- Minimises the amount of capital required by the assurance company.

iv.

- A deterministic model uses fixed future estimates to forecast a specific scenario
 - It usually involves being done separately for different scenarios.
 - And consideration given to the probability of each scenario.
- A stochastic model requires the statistical distributions of some or all inputs, to run hundreds or thousands of forecasts, and to output an estimate of the probability of the objective being achieved, e.g. the probability that a reference portfolio:
 - runs into a liquidity shortfall
 - achieves a surplus over the liabilities after 20 years
- Both models would require a method of forecasting:
 - Pay-outs required by the liabilities.
 - The deterministic model would use best estimates of mortality and pay-outs.
 - Future investment returns and hence prices of various securities.
 - The deterministic model could use best estimates of the future returns of the various assets or asset classes.
 - The illiquidity premium would be reflected in these returns. The lower the illiquidity premium the less sense it makes to take the risk of an illiquidity shortfall.
- A strategy (rules) for the future purchase and sale of securities / asset classes would be required.
 - This would require tracking the price of the securities, so we know at what price the purchases and sales would take place.
 - This could also be iterative, with more suitable rules being devised and explored once the results of the model run on previous rules are seen.

- Deterministic models are typically easier to build and quicker/cheaper to run frequently. Consideration should be given to whether:
 - sensible distributions can be constructed/obtained to enable the stochastic approach.
 - there are sufficient ongoing skills in the team to enable a stochastic approach.
 - by definition, do not consider all scenarios over all time periods.
- Deterministic models are also usually easier to understand.
 - The audience should be gauged.
 - Consistency with other models (e.g. capital) used in the business
 - Many insurers have management and experts who are highly skilled in stochastic techniques.
- If the stochastic route is chosen, it needs to be decided which elements of the model will be stochastic, and which elements will be deterministic (if any), e.g.:
 - Asset returns are commonly modelled in a stochastic manner.
 - Asset liquidity, this is less likely to be stochastically modelled and it may be difficult to devise distributions for this, but additional effort in this area is warranted, given the focus of this exercise is on liquidity.
 - Correlations hard to source independently so model may be biased
 - Can hide path dependency i.e. solvent by end of year 5 but actually bust in year 3
 - New business
 - Pay-outs e.g. this may be based on a distribution for mortality rates.

v.

Both types of model require the profile of the liabilities and associated cash flows to be defined as well as sets of reference asset portfolios as input:

- The process could be iterative, with the results of running the model being used to devise new, more appropriate, sets of reference assets and reference liabilities.
- Sets of insurance contracts (and their expected cash flows / pay-out profile) to serve as **reference liabilities**:
 - The starting point is the current in-force book.
 - Allow for decrements as appropriate.
 - A decision needs to be made whether to include new business in the exercise, and if so:
 - A forecast would be needed of the level and types of insurance contracts making up the assumed new business during each future time period.
 - New business levels are typically difficult to predict, and have a high degree of variance.
- Different scenarios for new business could be used for the deterministic model, with probabilities attached to each.
 - It could be decided to run this element of the stochastic model on a deterministic basis, or
 - It is possible for a distribution to be determined of future new business as input into the stochastic model.
- Different compositions of **asset** portfolios:
 - Decide on the asset classes to be included.

- Decide on the level of granularity required within asset classes, i.e. the sub-categories of asset types and level at which assets are grouped.
 - Considerable detail would be required in some areas, including the details of each debt instrument to be invested in (e.g. term, coupon payment, principal payment, liquidity).
 - Where appropriate, securities could be grouped, e.g. listed local equities.
- Decide on any constraints or limits to be applied to any of the asset classes or assets.
- To maximise the illiquidity premium, the insurer will want to include asset classes likely to maximise the illiquidity premium while also matching the pay-out profile of the liabilities.
 - This is usually unlisted bonds and unlisted short-term money market instruments, but could also include the use of swaps.

[Total 23]

[Grand Total 100]

END OF EXAMINATION