

# INSTITUTE AND FACULTY OF ACTUARIES

## EXAMINERS' REPORT

September 2018

### Subject SA5 – Finance Specialist Applications

#### Introduction

The Examiners' Report is written by the Principal 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 2018

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

1. The aim of the Finance Specialist Applications subject is to instil in successful candidates the ability to apply knowledge of the United Kingdom financial environment and the principles of actuarial practice to the financial management of clients' affairs.
2. The SA5 exam generally requires bullet point form or short form essay style answers that apply general principles to directly address specific circumstances. The answers given below are the most suitable but are just one possible set of acceptable answers.

**B. General comments on *student performance in this diet of the examination***

1. The paper covered a normal range of topics, including capital projects, credit analysis, market environment, hedging and financial risk management. Where questions contained more unusual scenarios, students were guided through these with preambles and smaller subquestions.
2. Overall student performance was satisfactory.
3. Question 2 asked students to apply the concepts of institutional risk management to an individual. Many students either failed to recognise this or found the 'conversion' difficult.
4. Subquestion 4 (iii) contained a minor error in the preamble. Students who followed the (incorrect) suggestion were nevertheless awarded appropriate credit.
5. This paper had no calculation sections however marks would be awarded for workings in the case of numerical answers.

**C. Pass Mark**

The Pass Mark for this exam was 58.

## Solutions

### Q1

(i)

- Failure to pay principal on redemption/maturity date [1]
- Failure to pay interest on due date [1]
- Payment restructure / holiday to postpone payment of interest or maturity proceeds
- Conversion of debt into another type of security which pays back on worse terms than the original security

[Max 2]

A comparatively easy question with high marks by most students.  
Breaching covenants is not typically considered a default – it may impact future debt raising or cause other immediate issues but would not of itself be considered an act of default.

(ii)

- The structural method, which essentially models the credit derivative using an options theory approach [1]
- The reduced-form method, is a technique based on modelling random times; which uses the survival probability of a reference instrument or entity, or, more specifically, the hazard rate that represents the intensity of default. [1]

[Max 2]

A bookwork question which was well answered by most students.

(iii)

- The authority wants to minimise its interest outgo over the life of the bond [1]
- The authority anticipates receiving cash inflow at (predicable / regular) times throughout the bond's lifetime and use these to immediately reduce its interest or balance sheet burden [1]
- The authority believes interest rates will fall in future, therefore it wants to "exit" this bond progressively and replace the redeemed tranches with lower-paying new bonds. [1]
- There may (have been) high market demand for this type of security at the time...
- ... resulting in a lower coupon required compared with conventional bonds
- Sinking funds may have had tax advantages for the issuer or for investors
- The authority wanted to diversify its issued debt portfolio
- The authority's cash flow projection may have indicated a one-off final repayment would introduce cash flow strain
- The authority may have specific expertise in the issue or servicing of sinking funds

- The authority may have been poorly rated with investors demanding a periodic repayment approach

[Max 3]

An application question about a type of bond (sinking fund) not often seen but most students managed to score satisfactory marks. Answers needed to reference sinking funds specifically, rather than debt raising in general.

(iv)

- The bond may pay a higher interest rate than non-sinking-funds to compensate for the uncertain term of the bond [1]
- The investor may want to have some of his capital repaid periodically... [1]
- ... however it is not clear how he would ensure he is selected for redemption (i.e. receives a predictable repayment at various times) [1]
- The sinking fund repayments may match an outgo the investor has (e.g. a closed portfolio of annuities) [1]
- There may be tax advantages to the investor [1]
- The sinking fund issuer may be a (semi-)government entity which may have regulatory advantages to the investor
- The investor may wish to develop a relationship with the issuer (anticipation of future commercial benefits)

[Max 3]

A fairly standard question well answered by most students.

(v)

- Issue its own bonds in the capital markets [1]
- Mortgage any property it owns [1]
- Sell other assets (e.g. surplus equipment) to raise money [1]
- Fund-raising activities (parent donations, social events, etc) [1]
- Seek finance from crowdfunding schemes [1]
- Borrow from shadow banks/VC funds/other capital pools [1]
- Apply for funding from central government [1]
- Securitise an income stream (e.g. school fees) [1]
- Save up using e.g. increased school fees (will take a long time so not an ideal solution) [½]

[Max 3]

Most students were able to score good marks for this question. Some proposed the school could issue equity which is unlikely – a school is normally not owned by shareholders (or listed) and the question refers to finance being provided by the local authority, i.e. a publicly-owned school.

(vi)

(a)

- the main purpose of a credit analysis is to establish the borrower's ability to repay the loan (interest and principal) from his future income or other sources [1]
- ... and to establish the value (/appropriateness) of any security or guarantees offered for the loan

(b)

- use any published credit ratings (although highly unlikely these will exist for the school on its own)
- will need to obtain school's financial statements (income statements and balance sheets) for, say, 3-5 years
- try to establish future surplus income ...
- ... using historical data and trends
- ... including additional forecasts taking new sports field into account (e.g. ability to rent new facilities to other customers)
- look at key historical accounting statistics like
  - net income / surplus every year
  - net assets
  - interest coverage
  - compute annual quick ratio =  $\frac{\text{current assets}/\text{current liabilities} = \text{cash} + \text{ST securities} + \text{receivables}}{\text{current liabilities}}$
  - compute Altman's Z score =  $[Z = \frac{3.3 \times \text{earnings before interest and taxes} + 1 \times \text{sales} + 1.4 \times \text{retained earnings} + 1.2 \times \text{working capital}}{\text{total assets} + 0.6 \times \text{market value of equity} / \text{book value of debt}}$   
[other suitable accounting ratios or measures which capture the ability to pay interest or principal would similarly score marks]
- what security can school offer?
- e.g. the land on which the facilities are being developed
- will the regional authority guarantee anything (may not be worth much now, but it could return to solvency in the future)
- levels of existing debt (if any) to determine maximum total indebtedness
- yield of any existing debt
- behaviour of any historical debt issues (whether serviced and repaid on time)
- other potential guarantors
- find credit history for any similar schools (e.g. in same region or serving similar socio-economic group)
- buy/rent and use a credit rating system or software from a rating agency, or pay them to do the work

[Max 5]

Most students were able to score good marks for this question with a large number of ideas available.
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(vii)

- usually these commitments will occur some time the future (typically years)

- a debt issuer will normally pay its debt commitments before paying anything to equity holders (standard capital structure hierarchy but also consequences of failure to repay debt are much greater than failure to pay dividends) [1]
- the issuer will take from accumulated savings (retained earnings or other cash resources) to pay its current debt outgo – i.e. will take from equity capital to pay debt coupons (including possibly raising new equity capital to pay off debts) [1]
- therefore if the company makes short-term profits/successes or losses/failures, this will not necessarily have an impact on bondholders...
- ... if, for example, there were adequate resources to meet debt commitments regardless of the success/failure of current activities
- only if the short-term event affects [perception of] the issuer's ability to repay its debt will there be an impact on credit quality and hence bond prices
- all equity will normally be wiped out before bondholders suffer any loss (subject to any negotiations that may take place)...
- ...therefore the time to "nil recovery" for an equity is shorter than for a bond
- Even as a bond's maturity approaches, short-term cash flow becomes paramount but the equity's 'duration' can be shorter still (i.e. if there appear to be insufficient resources to repay the immediate bond, the equity valuation horizon will finish before the bond one)
- In summary there is some truth to the analyst's statement

[Max 3]

A testing question exploring the idea of 'analysis time horizon' which most students found difficult.

(viii)

- It is a form of sale and leaseback transaction – the school sells the land but then pays an annual amount to use the (redeveloped) facilities [1]
- Could also say a financial lease
- ... or with appropriate explanation, a securitisation (although no SPV is used – the asset is sold to a related party)

[Max 1]

Most students found this difficult which was somewhat surprising.

(ix)

- the school replaces land on its balance sheet with cash (proceeds of the sale) and this cash (plus other resources) will be used in future to pay the annual charge benefits to the school include:
- the school does not need to raise new finance – it monetises an existing asset by selling the land
- the cost of 'renting' the facilities later on may be less than the cost of borrowing the money to develop them
- the school may be financially better off because it can invest the cash whereas the land was (most likely) not earning any income in its undeveloped state

- the school may obtain a good price for the land because of the ability to turn part of it into residential homes
- the developer takes care of the construction of the field, i.e. the new owner is directly involved in the execution of the transaction
- the new homes may provide a supply of students to the school disadvantages to the school include:
- the developer may acquire the land at a favourable price if school is motivated to sell (i.e. the school wants to make the trade because it needs the sports facility and may therefore not get the best price possible for the land)
- the school loses the option to use the land for other purposes later on (e.g. expand its classrooms)
- the school may not be directly involved in maintaining the fields – loses control over the repair and condition of the facility risks to the school include
- the school is exposed to the annual charge which may increase in future
- if the school loses the cash (e.g. poor investments or deficits elsewhere which must be funded) it may be unable to pay the charge
- the developer may deliver a substandard training facility
- new residential units may impede sports activities (e.g. noise, parking)
- if property values increase, the school no longer benefits
- the developer may renege on the transaction (e.g. by themselves going insolvent)
- the developer may wish to sell the field in future creating tension or a loss of facilities

[Max 5]

A wide ranging application question where most students scored good marks.

[Total 27]

## Q2

(i)

- Morbidity / disability risk
    - The individual may get ill or disabled/injured, increasing their costs they need to care for themselves
  - Longevity risk
    - The individual may live longer than they anticipate and hence use up all of their money before they die
  - Expense risk
    - The individual may spend more money each year due to higher expenses than anticipated.
  - Market risk
    - Investment in any assets that are not risk-free may create losses causing the individual to run out of money
  - Lapse risk
    - For the individual this is the risk that payments you are expecting to receive do not appear in practice. This is equivalent of a job or other income, leaving you with fewer assets than expected.
  - Operational risk
    - The individual may make an error or be the victim of fraud causing a loss of assets
  - Counterparty default risk
    - The individual may invest into institutions or products which become insolvent
- ½ mark for naming the risk and ½ mark for the explanation

[Max 4]

A relatively straightforward risk question.

(ii)

- The use test Statistical quality standards
- Calibration standards
- Profit and loss attribution
- Validation standards
- Documentation standards

[Max 2]

An easy bookwork question with high marks by most students.

(iii)

Use test

- There must be a demonstration that the model is widely used.
- It is unlikely that the use test can be demonstrated at all for the individual and is arguably not relevant as it is being used to provide a piece of advice.

- The individual is unlikely to use the model for making key decisions and certain aspects are not relevant, for example the ability to allocate capital to various risks or, for an insurer, lines of business

#### Statistical quality standards

- A number of minimum quality standards must be met relating to assumptions and data
- Given that a model would be built for an individual it will be difficult to produce a probability distribution based on any past data.
- There will be a high degree of expert judgement required in the individual assumptions
- The materiality to the individual will be set at a low level meaning that small changes in assumptions could easily break the materiality thresholds

#### Calibration standards

- The model has to produce a capital requirement calibrated to a value at risk of 99.5% over one year
- For the individual, a period greater than one-year may well be chosen in the model. For an internal model, equivalence would need to be shown that it meets the correct level of probability over a one-year time horizon.

#### Profit and loss attribution

- There is a requirement to demonstrate how the categorisation of risks explains profits and losses.
- It would be useful for the individual to understand over a period whether they are meeting any targets set for the amount of funds required to retire. This could be provided by a profit and loss attribution
- The level of detail required for an individual, and the sophistication of the analysis, is likely to be much less than for a typical insurance company.

#### Validation standards

- The model must have been fully validated and subject to regular review
- The cost of validation is typically high and the level required to meet regulatory expectations is unlikely to be warranted for this purpose.
- However, the ability to validate the results of the model against emerging experience, or to check via back-testing the model, would be useful as it would give some credibility to the results and would allow changes to the model to refine it.

#### Documentation standards

- The design and operational aspects must be thoroughly documented.
- Likely to be much less onerous than for a typical insurance company. Given that it is only for one individual, it is unlikely that there will be multiple users and hence the level of documentation usually required for an internal model would not be relevant.
- Documentation is expensive to produce and therefore the individual is unlikely to want the expense of extensive documentation.

[Max 4]

This was a follow-on to (ii) but many students found it difficult making points *in the context of the private individual*.

(iv)

- Inflation risk
  - The costs that the individual bears will be subject to inflation and there is the risk that the impact of inflation will be greater than anticipated, leading to lower funds being available than expected
- Longevity trend risk
  - There is the risk that the amount of longevity improvements allowed for in the standard formula are understated. With medical advances it may be that the individual lives far longer than anticipated and hence runs out of money.
- Liquidity risk
  - Whilst the individual may have sufficient assets they may not be liquid. For example, they may have concentrated their net worth in a property. Hence they could run out of money even if they are still relatively wealthy
- Operational risk
  - The individual may face any number of unique operational risks, including legal (e.g. being sued)
  - ... which would have a disproportionate effect since they would be binary (happen or don't happen, with no pooling of risks)
- Unemployment risk
  - The individual may become unemployed which will radically change their asset / liability profile
- Tax risk
  - The individual may be subject to disproportionate tax risk due to a limited spread of assets or income sources.

½ mark for naming the risk and ½ mark for the explanation|  
[Max 2]

A poorly-answered application question. Many students again found it difficult making points *in the context of the private individual*.

(v)

#### Strengths

- Risk-based capital gives a sound theoretical principle to determine the amount of capital required to cover a risk being carried, assuming that the risk can be appropriately quantified. [1]
- It allows the individual to compare the potential profit from a course of action to the cost of the potential loss and therefore understand whether they wish to take the risk
- It is consistent with recognising that taking on greater risk volatility as an individual carries with it a higher cost
- The amount that is derived can be used to compare the relative merits of a course of action in a quantitative way.
- Given that insurers also use the method it gives the individual in pricing their products it can give the individual an idea of whether they are able to obtain any arbitrage by taking out insurance.
- Risk based capital is an established technique that has gained wide recognition

- Improves client understanding of capital allocation

Weaknesses

- Because of the risk uncertainty it is difficult to determine whether the correct results are calculated. This will be a particular disadvantage in this case because of the difficulty in determining an appropriate basis for the calculation of the risks for this individual.[1]
- It will be difficult to derive the amount of inter-dependency for the risks carried by the individual, again adding to the uncertainty of the results.
- The results will be highly subjective and, for the individual, so subjective that they may only be useful to give a qualitative indication. The results will be subjective and it is likely that if someone else were to carry out the calculation they would derive a completely different answer.
- Applying the method could be very time-consuming and expensive (incl every time circumstances change)
- Portfolio assets and liabilities may be very unique and difficult to model (e.g. residential property; lawsuits)
- The method cannot be validated easily
- Model may be too complex for client to understand

[Max 5]

A fairly typical question although students found points *in the context of the private individual* more difficult to find.

(vi)

- Risk transfer
  - This involves contractually transferring the cost of any loss to another party, usually in exchange for a premium
  - Most common is an insurance policy, which the client could use for any number of contingencies
  - e.g. take out health insurance, life insurance, property insurance
  - e.g. buy an annuity or guaranteed pension contract
- Risk avoidance
  - Making decisions to prevent the risk from arising in the first place
  - The client could adjust their behaviour to avoid risky activities or locations
  - e.g. not living in particular areas, not participating in certain sports
  - e.g. spending control to avoid exhausting future retirement assets
  - e.g. not investing into certain types of products or schemes
- Risk reduction by loss prevention
  - preventing the occurrence of loss or reducing the frequency of loss
  - The client could take steps to secure her belongings and assets
  - e.g. have a burglar alarm at home
  - e.g. invest with regulated investment managers
- Risk reduction by loss control
  - reducing the severity of those losses that do occur
  - The client could separate assets so that any mishap affects only a subset of her wealth
  - e.g. store some valuables in a bank safe and others at home
  - e.g. have a diversified investment portfolio, probably pooled with others
- Disaster planning

- Have a planned course of action to use in event of an emergency
  - The client could consider more likely disasters to affect her based on where she lives, where she works and invests
  - e.g. have basic medical and food supplies or alternate accommodation available if living in a flood or earthquake area
  - e.g. have emergency cash somewhere other than the bank to use in case of a systemic bank failure
- ½ a mark per technique and ½ a mark for each description

[Max 5]

Another fairly typical bookwork/application question. Solutions needed to be sensible for a *private individual*. For example buying a CDS is unlikely to be suitable for a private person.

(vii)

- Management succession
  - next of kin nominated in the event of a disaster who could manage affairs for them.
- Evacuation procedures
  - In the event of a disaster at their place of residence the individual should have an evacuation plan to get out of the building in a safe way.
  - For financial assets 'evacuate' to safer assets in times of stress
- Warning systems
  - Maintaining smoke alarms would provide warning of fire, checking weather forecasts if living in an area prone to flooding or other severe weather would be necessary.
  - Setting portfolio alerts in event of particular value changes or threshold is crossed
- Emergency medical care
  - A plan to be able to get themselves or family to hospital in the event of an emergency, or to know how to treat common medical conditions, could be documented.
- Protection of records
  - Keeping copies of key documents safe, for example having copies in the cloud or stored elsewhere electronically, would prevent their loss being a problem in the event of a disaster
- Restoration procedures
  - Having a plan for reconnecting services quickly (utilities, builders) in event of natural disaster
  - Having plan for reconnecting to financial information and providers e.g. after identify theft

½ mark per point for each risk and ½ mark for the description

[Max 3]

Another fairly typical bookwork/application question, with the complication of applying to a *private individual*. Marks were reasonable.

[Total 25]

### Q3

(i)

Relevant elements of the UK Government's strategy are:

- Maintaining macroeconomic stability
  - Uncertainties around the process and final outcome are likely to increase volatility of financial markets (esp exchange rates) and business decisions (e.g. investment in new capacity)
  - Any subsequent trade restrictions will dampen economic growth, reducing available jobs and/or creating macroeconomic instability
  - If EU workers are obliged to leave a labour or skills shortage may result, which would destabilise the economy
  - Restimulating growth by lowering interest rates may in turn create inflation
  - Due to the uncertainty surrounding the working conditions for EU citizens, it may be difficult to get EU workers to be based in the UK. [1]
  - Inflation is likely to increase as a result of increased costs related to Brexit
- Meeting the productivity challenge
  - Productivity may be affected if leaving the EU results in more expensive imports of machinery from the EU
  - Also businesses may postpone technology upgrades while adopting a wait-and-see approach
  - Reduced real wages and increases in cost of goods could decrease motivation of workforce which could negatively impact productivity [1]
- Increasing employment opportunity for all
  - This may become easier if EU workers leave, creating spaces for UK workers
  - ... or harder if growth slows leading to redundancies
- Delivering high quality public services
  - If tax receipts fall due to slower growth the ability to provide quality services will be compromised
- Protecting the environment
  - Environmental protection standards may become less without pressure from the EU over standards

[Max 3]

A fairly typical bookwork/application question. Not all students were able to recall the elements of the macro strategy (which for example does not explicitly include economic growth). Marks were modest.

(ii)

- Leaving the EU could have a negative impact on sterling which could impact any fixed assets held by the utility, as well as impact the group's revenue from any European operations. [1]
- Increases in inflation could impact on revenue and costs especially if rates charged for the company's products (probably water, telecoms or energy) may be subject to UK or European price regulation, which may differ going forward. [1]

- The demand for products may be depressed as a result of increased inflation [1]
- Leaving the EU could lead to significant changes in the regulatory environment as EU wide regulation may no longer apply in the UK – this is particularly relevant if the utility's market is more highly regulated (as tends to be the case for many utilities) [1]
- There will be an increased risk the utility needs to apply differing accounting and other reporting standards (e.g. to local regulators) for the European and UK operations which would require additional resources [1]
- Any components which are imported/exported may be subject to tariffs which increase operating costs [1]
- Uncertainties around the process and final outcome are likely to increase risk for business decisions (e.g. investment in new capacity, reluctance of finance providers to get involved) [1]
- If any competitors choose to abandon their UK / EU operations as a consequence, the business environment will become more favourable. [½]
- The company may not be able to move its staff freely between UK and EU operation, or recruit staff with the necessary skills [½]
- Demand for EU product from the UK would be increased if the currency weakens or reduced tariffs are imposed [½]

[Max 3]

Most student answers were satisfactory.

(iii)

- Where the ABS has a prepayment option and borrowers are expected to prepay when refinancing rates fall below the loan rate, the valuation approach would be as for mortgage backed securities [1]
- Monte Carlo simulation methods are commonly used to value mortgage-backed securities, since the periodic cash flows are path-dependent (i.e. the cash flow received in one period is determined not only by the current interest rate level but also by the path that interest rates took to get to the current level).
- As noted above, potential prepayments of capital provide optionality within such securities. From an interest rate perspective, prepayment is likely to occur when refinancing rates fall below the inherent mortgage rate (or ABS rate in this case).
- The simulation involves generating a set of cash flows based on simulated future refinancing rates, which in turn imply simulated prepayment rates. The typical model used to generate random interest rate paths takes as input today's term structure of interest rates and a volatility assumption. (The simulations should be calibrated to the market so that the average simulated price of a zero-coupon Treasury bond equals today's actual price.) [1]
- The random paths of interest rates should be generated from an arbitrage-free model of the future term structure. The simulation works by generating many scenarios of future interest rate paths. In each period of the scenario, an interest rate and the mortgage [ABS] refinancing rate are generated. The interest rates are used to discount the projected cash flows in each scenario. The mortgage [ABS] refinancing rate is needed to determine the cash flows because it represents the opportunity cost that the mortgagor is facing at that time. [1]

- Prepayments are projected by feeding the refinancing rate and loan characteristics (such as age) into a prepayment model. Given the projected prepayments, the cash flows along an interest rate path can be determined.
- The theoretical value of the security can then be determined by calculating the average of the present values of all the interest rate paths.
- The option-adjusted spread (OAS) is then the spread that will, when added to all the spot rates on all interest rate paths, make the average present value of all the paths equal to the observed market price (plus accrued interest).
- In practical use, a drift term is added to the short-term return generating process so that arbitrage-free values are produced. Mean reverting models are used to limit the scope of the interest rates generated. Variance reduction techniques are employed to cut down the number of sample paths necessary to get a good statistical sample. Representative path methods are also used to reduce computational time — a small representative number of interest rate paths are selected from the large number originally generated, and the security valued on each representative path. A weighted average of these security values is then used to calculate the average present value.

[Max 4]

A more difficult question. Most students were able to make a handful of points – such as suggesting a simulation would be used – but not much beyond that. Marks were accordingly modest.

(iv)

- Interest rate risk:
  - Coupon payment likely to be fixed, hence potential loss from interest rate rises in the future.
- Prepayment risk:
  - Given the borrower's ability to prepay when rates are lower, the investor faces reinvestment risk of potentially having to reinvest at lower rates
- Market risk:
  - Exposure to mark-to-market losses,
  - Market losses more of an issue if the investor not able to hold on till maturity
  - security may continually trade at a discount if markets aren't comfortable with the untested technology of solar farms etc
  - higher inflation may erode real value of security
- Credit risk:
  - Risk of sponsor defaulting on payments
  - Less of an issue if the assets backing the debt are of high quality and readily realisable
  - Risk of a poor recovery value if no one interested in buying the assets (eg due to technology becoming obsolete, or unfavourable regulation)
- Off-balance-sheet activities
  - Only part of the assets were backing the ABS (the higher quality assets were excluded) ...
  - and control of the capital structure lies with more senior layers of debt, or other undisclosed liabilities
- Product, operational and technology risk

- Risk of failure of wind assets due to manufacturing fault, or the technology becoming obsolete
- Unusually low levels of wind meaning less revenue than expected, or
- Other renewable sources (eg solar) becoming the preferred source of power
- Company maintaining, servicing or help with the running of the solar farm withdrawing and no replacement available.
- Foreign exchange risk
  - Risk if the ABS is denominated in a different currency to that of the investor
- Political risk
  - Risk government interference, or risk of nationalisation
  - Project may have received subsidies, and this may be withdrawn
  - Local community protesting claiming the solar farm ruins a beautiful landscape
  - The wind farm or the ABS may have received favourable tax treatment and this can be revoked.
  - Leaving the EU and how this is achieved is a large political risk
- Liquidity risk
  - Not able to sell the ABS when needed due to poor market liquidity conditions
  - This may be due to some unusual features of the security or that the market struggle to put a value on the solar assets backing the security
  - Less of an issue the shorter the duration of the ABS
- Compliance risk
  - May no longer be classified as admissible or in breach of own compliance limits, and may result in a fine etc
  - Or issues resulting from fraud by key related stakeholders.

½ mark for naming the risk and ½ mark per explanation|  
[Max 6]

A fairly typical question satisfactorily answered by most students.

(v)

Interest rate risk:

- Interest rate swap (fixed to floating) to hedge interest rate risk

Prepayment risk:

- Difficult to hedge – should have pre-agreed reinvestment options before prepayments are made
- Could have interest rate put options which pay out when rates fall - not completely clear what threshold though
- Could require suitable notice period before making prepayment (to allow investor to consider alternatives)

Market risk:

- Market hedges – could do broad credit hedge via short credit index exposures, though this carries high basis risk
- Manage portfolio liquidity profile to allow the investor to hold till maturity if required
- Inflation swap to manage inflation risk

Credit risk:

- Purchase credit default swap (CDS) hedge on relevant counterparties if available

- Monitor credit rating, and have risk controls around exposure to lower rated debt
- Assess and monitor quality of assets backing the debt (ensure adequate or over-collateralisation or obtain guarantees)
- Monitor potential changes in regulation, new technologies etc that may adversely impact the quality of the assets, to enable pro-active management of new risks
- Negotiate tranching of the ABS security to offer different levels of credit risk

Off-balance-sheet activities

- Ensure legal terms of which assets are included, and how these are controlled etc are enforceable and there are appropriate break clauses etc
- Buy exposure to the controlling (fulcrum) part of the capital structure)

Product, operational and technology risk

- May require specialist advice on the operational and technology related risk in the case of new solar technologies, to enable a fair assessment and management of the risks
- May purchase weather insurance contracts that pays out if sun shine is below required levels for this investment
- May consider diversifying into other renewable technologies such as wind farms to manage concentration risk
- Purchase insurance against operational risks (e.g. trade errors)
- Carry out suitable due diligence

Foreign exchange risk

- Purchase currency forward contract to hedge the currency risk to the currency of the investor

Political risk

- May require specialist advice to assess and manage this risk
- May consider lobbying government or local community for continued support of these clean energy projects

Liquidity risk

- Manage the size of the purchase to allow for limited liquidity of the ABS
- Consider negotiating features of the ABS that would make it more liquid or more popular in the investment community
- Consider investing in shorter rather than longer duration ABS contracts
- Identify potential parties in advance (maybe working with brokers) that may be interested in purchasing the asset and look to negotiate potential liquidity to transact directly when needed

Compliance risk

- Check both current legal requirements as well as upcoming legal and compliance amendments to manage compliance risk
- May need specialist advice or get an independent compliance firm to sign off on the compliance aspects
- Purchase insurance against fraud or other issues.

[Max 6]

Another fairly typical question but comparatively poorly answered. Some students suggested total return swaps which would tend to *eliminate* risk rather than manage it.

(vi)

- A summary measure of market risk is Value at Risk (VaR) which, in concept, is extremely simple...
- ...being a probability statement about the potential change in the value of a portfolio resulting from changes in market factors over a specified time interval.

Main issues:

- Insufficient data to conduct empirical checks on the validity of the model using reasonably current data.
- Its reliance on the normal distribution. If changes in the value of derivatives portfolios or default probabilities have “fatter” tails than those implied by a normal distribution, management would end up significantly understating the probability of distress.
- Given the multi-variate and resulting non-linear nature of this instrument, it is unlikely that a normal distribution would give good estimates of losses.
- Simplicity of measure doesn't allow for full description of the risk 'surface', it's analogous to having say only the mean for a distribution and no other descriptive statistics
- Problems with holding periods
  - A 24-hour liquidation period is probably reasonable for a small position in a liquid currency pair, but a large position in equities is probably going to be harder to dispose of. The ABS instrument would be less liquid than equities.
  - There is no easy answer to this issue, particularly since the “typical” liquidation period which can be observed in normal markets can rapidly deteriorate in a crisis.
- Problems with current price / payoff profiles
  - Many financial instruments exhibit a non-linear price / payoff profile. While this “curvature” is particularly acute in the case of options, even straight bonds behave in a slightly non-linear fashion if observed over a big enough change in interest rates.
  - Given the embedded optionality from pre-payment and nature of assets backing it, this ABS would not have a linear pay off profile. Thus, one cannot scale the potential loss calculated at a given holding period and confidence interval to another level, unless the extent of the curvature is known.
- Problems with correlations
  - Whilst VaR is a very good tool for monitoring the riskiness of a single risk factor and, perhaps, even for allocating capital within a single trading area, the high reliance on correlations as one moves up the aggregation “tree” renders the numbers less and less reliable. The higher up the consolidation tree we go, the more the correlations dominate the overall calculation. It is worth testing to see just how sensitive the total VaR can be to changes in these parameters.
  - Correlations may be difficult to compute/estimate
  - VaR also does not deal well with dynamic correlations (e.g. which change rapidly during times of stress)
- Problems with observation periods
  - The observation period may be too short (missing key historical observations) or too long (underweighting current observations).

[Max 3]

Most students were able to identify and comment on the relevant aspects of VaR with satisfactory answers.

(vii)

- In practice, calculation of a single VaR number is not sufficient for successful risk governance. In addition, we should:
- Conduct sensitivity analysis to assess how sensitive the VaR is to the data set used.
- Carry out scenario analysis to assess the effect of specific extremes of market conditions.
- Carry out stress testing by changing the parameters of the model, to see what happens to the VaR number if the values of market factors move outside their current confidence intervals or the current data correlations break down.
- Back test the VaR to see how it has performed relative to realised losses.
- Much of the above could be done on similar instruments (with better data) that can be used as a close proxy.
- Qualitative assessments of the risks from experts could be used to help interpret and supplement the results of the above analysis.
- Use additional measures, like Tail VaR which calculates expected loss given a specific loss threshold has been achieved
- ... or market beta

[Max 2]

Students who mentioned 'simulation' needed to elaborate on this as both VaR the alternatives would also typically require simulations. Answers were satisfactory.

(viii)

- 1. Total capital is allocated in the proportion that the stand alone capital for the activity bears to the sum of the stand alone capital requirements for all of the activities. [1]
- 2. Marginal capital is first calculated for each activity as being the additional capital needed to introduce the activity to the rest of group of activities. Marginal capital can be negative. Total capital is allocated in the proportion that the marginal capital for the activity bears to the sum of the marginal capital requirements for all of the activities. [1]
- Management may consider that it is not practical to allocate negative capital to an activity. Hence, the marginal capital calculations are made as in 2 above excepting that the minimum marginal capital for a given activity is deemed to be zero.

[Max 2]

A poorly answered question.

[Total 29]

## Q4

(i)

### Interest Rate Cap

- An Interest Rate Cap can be used to fix payments at regular intervals for a specified notional. A cap can be purchased such that the loan payments are fixed at the cap rate. [1]

### Interest Rate Swap

- A payer swap will pay the difference between a fixed rate (swap rate) and a floating rate at specified dates. [1]
- A payer swap can be purchased for the same notional as the loan so that the loan payments are fixed at the swap rate. [1]

### Interest Rate Collar

- An interest rate collar is an instrument where the buyer buys an interest rate cap for a specified rate and sells a floor at a lower rate. The collar enables the loan payments to be fixed at the cap rate when interest rates rise. [1]  
[Max 3]

A reasonably straightforward question with most students scoring high marks.

(ii)

### Interest Rate Cap

- The dynamics of the interest rate cap are easy to understand.
- The fixed rate and expiry date can be easily tailored by the buyer.
- The buyer retains the advantages of lower interest rates. [1]
- An interest rate cap requires an initial premium to be paid and this could be expensive depending on the notional and fixed rate.

### Interest Rate Swap

- A swap is cost free.
- The terms of a swap can be tailored to the needs of a buyer
- Interest rate swap dynamics are easy to understand and explain.
- There is less flexibility with an interest rate swap as they are usually exchange traded
- The counterparty may demand collateral to help mitigate credit risk
- The buyer loses the benefits of interest rates falling and in some cases, this may become prohibitively expensive. [1]
- InsurePool may need to pay a significant amount to exit the swap arrangement if they receive enough capital to pay off the loan

### Interest Rate Collar

- An interest rate collar is cheap and it can be constructed so that it has zero cost. [1]
- The buyer loses the benefits of interest rates falling and in some cases, this may become prohibitively expensive. [1]
- InsurePool may need to pay to exit the arrangement

For all

- InsurePool accepts credit risk on the seller who may not pay the swap/cap/floor amounts due
- Any method may be disadvantageous from a capital or liquidity management perspective if periodic margin payments are required

[Max 6]

Most students were able to make some points although complete answers were rare.

(iii)

- The product caps future floating (LIBOR-linked) payments
- The policyholders will take up the guarantee at various dates hence the payoff mimics that of a series of interest rate caps [1]
- Where InsurePool have sold the caps to the policyholders
- Determining the value of the liabilities would be the same as determining the value of an equivalent interest rate cap...
- ... where the fixed rate specified in the policy will be equivalent to the forward swap rate
- The notional amount for the caps will be the same as the amount which is used to calculate annual payments in the policy.
- The tenor for the caps will either be specified in the policy documents or if it is linked to a specific form of education (e.g. primary school) then the typical length of that form of education can be used as the swap tenor. [1]
- Monte Carlo simulation methods would be used to value the liability
- ... using an appropriate interest rate model
- Discount periodic cap cashflows to the present at an appropriate discount rate
- May include additional margins
- Could use Black-Scholes to value the individual caps [1]
- Higher interest rate volatility will therefore increase the product liability

[Max 5]

The question contained incorrect guidance to students that the product resembles a swap (it resembles a series of caps). Candidates who attempted to describe the valuation of a swap received some credit for their attempts.

(iv)

Collateral

- In general collateral is used to provide security to the bondholder that in the event of default, the bondholder has claim to the collateral
- It is not obvious what collateral the company could provide...,
- ..., given that its head office is likely to be pledged to the bank (for the loan received)
- ... and the remainder of the company's assets are used to back policyholder liabilities
- This alternative is therefore likely to be unsuitable unless the company has free assets which it can use as collateral

Credit default swap

- In general a CDS is used to insure the bondholder against losses by providing a predefined payment on default
- The suggestion appears to imply the company is insuring its own debt
- This provides no security at all to the investor...
- ... because the CDS will require payment at the same time as the company has defaulted on its obligations...
- ... i.e. when it has no spare resources to give
- If policyholder funds are used to underwrite the CDS this would be a form of self-investment...
- ... which is unlikely to pass regulatory scrutiny ...
- ... or meet policyholder reasonable expectations.
- This alternative is therefore wholly unsuitable

[Max 3]

Beyond the initial definition, students need to assess whether collateral/CDS would work in this case to earn marks. In this case both ideas were unsuitable.

(v)

- Financial slack refers to having ready access to liquid funds and borrowing facilities when needed.
- A new (start-up) business is likely to be running as 'lean' as possible in order to become established with the minimum amount of capital
- Its business plans are likely to be on the optimistic side already (to persuade investors to buy shares or bonds in the company with a promise of outsized returns)
- In this context, it is unlikely the company will be able to raise and retain *unneeded* funds
- In fact it may struggle to raise *needed* funds
- Seed investors may impose limits on further borrowing or equity dilution
- The shareholder is correct that if it were able to raise surplus funds (or untapped credit lines) this would probably allow it to grow even faster
- However the suggestion is of limited use as a start-up company will already be trying to maximise its available capital, and will be unlikely to be intending to pay any of it out to shareholders

[Max 2]

A comparatively straightforward bookwork/application questions which was nevertheless poorly answered by most students.

[Total 19]

**END OF EXAMINERS' REPORT**