INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

September 2011 examinations

Subject SA4 — Pensions and other Benefits Specialist Applications

Purpose of Examiners' Reports

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 who are 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. Although Examiners have access to the Core Reading, which is designed to interpret the syllabus, the Examiners are not required to examine the content of Core Reading. Notwithstanding that, the questions set, and the following comments, will generally be based on Core Reading.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report. Other valid approaches are always given appropriate credit; where there is a commonly used alternative approach, this is also noted in the report. For essay-style questions, and particularly the open-ended questions in the later subjects, this report contains all the points for which the Examiners awarded marks. This is much more than a model solution – it would be impossible to write down all the points in the report in the time allowed for the question.

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Chairman of the Board of Examiners

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General comments on Subject SA4

This subject examines the ability of candidates to apply actuarial practice and concepts, together with specific knowledge of the UK pensions and employee benefit environment to potentially complex problems, integrating their analysis into a coherent whole, and evaluating and interpreting results to draw explicit conclusions.

The examiners therefore look for candidates to demonstrate their understanding of the syllabus by applying their knowledge and core actuarial skills to the specific situation that the examiners asked, having read the question carefully. Too many candidates write around the subject matter of the question in more general fashion, reproduce core reading that appears to them be relevant without linking it to the question context, or focus on one aspect of the issue at great length, in each case gaining few of the marks available.

Good candidates demonstrate that they have used the planning time well – an attempt to create a logical structure to solutions is a big advantage in making points clearly and without repetition. This also enables candidates to use the latter parts of questions to generate ideas for answers to the early parts (or use their solutions to earlier parts of questions to create a structure for latter parts). Time management is important so that candidates give answers to all questions that are roughly proportionate to the number of marks available.

Comments on the September 2011 paper

The overall standard of scripts was consistent with previous sittings. Candidates generally scored well on question 1 parts (i) and (ii), question 2 parts (i), (iii) and (v), and question 3 part (i). Apart from question 2 part (ii), it was noticeable that the parts of questions that required drawing an analysis into a coherent whole (e.g. question 1 part (iii)), or critical evaluation (e.g. question 3 part (iv)) caused candidates most difficulty. The Examiners encourage future candidates to remind themselves of what they learned in the Core Actuarial subjects, and to use past paper questions to practice these skills.

1 (i) Main risks are:

- the size and volatility of the deficit is large relative to sponsor
  - on both technical provisions basis (large)
  - and discontinuance basis (even larger)
- may need to sell assets at an inappropriate time
- asset and liability mismatch,
  - high level of risky assets vs large pensioner liability
- the employer (weak covenant) becomes insolvent **and** there is a deficit on the discontinuance (on bu**you**t) basis
- longevity risk – pensions are paid for longer than anticipated
- inflation – the level of benefits are higher than anticipated

Part (i) was well answered, with many candidates scoring full marks. Some candidates included far too much detail for the allocated marks, including risks that could not be regarded as "main risks", or simply listing every risk they could think of without "outlining" them in any way.

(ii) **Close the scheme to future accrual/switch to career average/introduce salary increase cap**

- active members lose link to final salary benefits
- so they effectively become deferred members
- and scheme is likely to fully mature even more quickly

Advantages/Disadvantages

	Employer	**Member**
depending on the scheme rules, likely to reduce the size of the deficit	✓	-
because active members would lose their link to final salary	✓	x
and future increases to accrued benefits would be replaced with a (lower) link to future inflation or other cap	✓	x
this option would have limited saving for the employer	x	-
because it affects less than 30% of the liabilities	-	-
size of deficit reduction depends on the proportion of active members, and • average age of active members – if close to retirement, limited cost saving, and • the real salary increase assumptions – i.e. if small, then very little saving may be realised	-	-
reduced costs on future service benefits could be diverted to meet deficiency	-	✓
there may also be HR, legal and publicity issues to contend with when communicating it to members	x	-
and sponsor's interest in the scheme may eventually diminish as the deficit becomes a "legacy" that it doesn't care about	-	-

Lower risk investment strategy

- the scheme is very mature
- so very likely that contribution income will be significantly lower than benefit outflow
- so liquidity becomes a major issue
- and the assets currently held do not match the liabilities
- so the scheme could benefit from a greater proportion of bonds and very liquid assets
- holding bonds or swap contracts that match the duration and nature of the liabilities – e.g. bonds currently held are fixed, but benefits are inflation linked
- diversification into other classes to reduce risk of poor performance of UK equities and UK corporate bonds – e.g. global equities, property, private equity, hedge funds, government bonds, global corporate bonds etc.

Advantages/ Disadvantages

	Employer	**Member**
this reduces the volatility of the deficit	✓	-
and reduces the volatility of the reported pension costs in company's accounts	✓	-
trustees might favour this as there's more security for members' benefits	-	✓
does not reduce longevity risk	**x**	-
no reduction in member's benefits	-	✓
but this solution would reduce the expected future investment returns	**x**	-
so could increase the size of the deficit relative to the technical provisions	**x**	-
and have longer recovery periods in the future	**x**	**x**
so increases the cost to the company in terms of: • cash contributions to the scheme • and reported pension costs in the company's accounts	**x**	-
all investment risk will be impossible to eliminate	**x**	-
especially if the scheme is cashflow negative	-	-
change incurs significant transaction costs	**x**	-
may not be a good time to switch assets	**x**	-
reduction in PPF levy when investment risk starts to be taken account of	✓	-

Full or partial buyout with an insurer

- relevant assets and liabilities (and associated risks) would be transferred to an insurance company

Advantages/ Disadvantages

	Employer	**Member**
employer no longer needs to worry about pension risks secured	✓	✓
and trustees have a clean break from or reduce reliance on the "weak" employer	-	✓
so more secure than relying wholly on the employer's covenant for future security	-	✓
and favourable for trustees as it's the ultimate way to secure members' benefits	-	✓
if buyout market is buoyant and competitive, may be able to obtain reasonable prices in short and/or medium term	✓	-
is the most expensive option	**x**	-
as contributing to profits of insurance company	**x**	-
and very likely to be unaffordable to the employer immediately, given the size of the deficit relative to the size of the employer	**x**	-
but could aim for buyout funding target over the long term	**x**	✓
if buyout liabilities too large, may need to split over two or more insurers – so potentially less competitive pricing	**x**	-
exposed to covenant of insurance company	-	**depends**
benefits provided in the event of insolvency of insurer may not be better than PPF	-	**x**
partial buyout reduces security for remaining members	-	**x**
should reduce PPF levy	✓	-

Buy in the pensioners' liabilities

- annuity policy would be an asset that sits alongside the rest of the scheme's investments
- so only part of the assets and liabilities will be "removed"
- and trustees retain overall responsibility for pensioners
- Essentially a trustee investment, so members notice no change

Advantages/ Disadvantages

	Employer	**Member**
likely to be more affordable (than full buyout) for the company	✓	-
because the UK buy in market has more insurers and is usually more competitively priced	-	-
and, depending on price, might even be a cost saving to the scheme	✓	-
given large pensioner liabilities, opportunity to spread risks to two or more insurers – especially if employer wants to buyout non-pensioners at a later date	✓	-
Trustees run the risk of insurer becoming insolvent	-	**x**
and only the volatility of the pensioners' portion of the deficit will be reduced	✓	-
trustees still exposed to strength of employer covenant	-	**x**
and trustees still responsible for managing the risks for the non-pensioners	-	**x**
and responsible for managing the scheme as a whole	-	-
Future valuations of the scheme – value of insurance contract may be difficult to obtain	-	-
If size of pensioners liabilities too large then may have to use more than one insurer	**x**	-
so price may not be as competitive or arrangement might be complex	**x**	-
reduction in PPF levy when investment starts to be taken into account	✓	-

Enhanced transfer value incentives

- provide incentives for deferred members to take transfer values
- which could be to increase the transfer amount payable through the scheme
- or the employer could pay cash separately to each transferring member

Advantages/ Disadvantages

	Employer	**Member**
this option would reduce the size of the deficit because transfer values are usually lower than value of liabilities on technical provisions and discontinuance bases	✓	**Depends**
May be low take up rate by the members, so no guarantee there would be a sizeable reduction in the overall liabilities and deficit	**x**	**-**
and limited reduction in deficit because deferreds are only a small portion of membership (i.e. 30% or less)	**-**	**-**
and may have to pay high adviser fees to ensure it is not seen by members as mis-selling	**x**	**-**
reputational risk for employer	**x**	**-**
Depending on age profile, cash incentives may need to be high (and potentially unaffordable)	**x**	✓
Exercise often undertaken prior to a buy out exercise	✓	**-**
TV can be more flexible for members so appreciated more	✓	✓
Members lose protection of PPF	**-**	**x**
But not dependent on sponsor covenant	**-**	**Depends**

The Examiners were very sympathetic to a small number of candidates who combined ETVs and PIEs into one "Liability Management" option, and ensured they received appropriate credit for the range of points they made.

Pension Increase Exchange

- Option for members to exchange guaranteed pension increases for a higher pension with nil or lower increases
- Increase depends upon proportion of saving, if any, retained by company
- Members may appreciate flexibility

Advantages/ Disadvantages

	Employer	**Member**
this option would reduce the size of the deficit because value of increased pension usually lower than value of original pension with guaranteed increases on technical provisions	✓	**Depends**
and if ultimate buy out is the aim, terms for fixed pensions are more competitive than increasing pensions	✓	-
May be low take up rate by the members, so no guarantee there would be a sizeable reduction in the overall liabilities and deficit	**x**	-
and may have to pay high adviser fees to ensure it is not seen by members as mis-selling	**x**	-
reputational risk for employer	**x**	-
increases PPF levy (at least in shorter term)	**x**	-
Members in poorer health may select against the Scheme	**x**	✓

The Examiners were very sympathetic to a small number of candidates who combined ETVs and PIEs into one "Liability Management" option, and ensured they received appropriate credit for the range of points they made.

Other liability routes

- Encourage or take up of early retirement
- Or commutation
- Particularly trivial commutation
- Often initial part of a buyout/buy in as cheaper to buy immediate rather than deferred annuities
- Review discretionary practices to avoid unintended additional liabilities

Advantages/ Disadvantages

	Employer	**Member**
Easy to apply and administer	✓	✓
Members may appreciate accessing pension entitlement earlier	-	✓
May be low take up rate by the members, so no guarantee there would be a sizeable reduction in the overall liabilities and deficit	**x**	-

{NB Additional credit was not given if more than 5 options considered}

Whilst the majority of candidates identified the main risk reduction options, only the stronger ones gave a complete description and identified the main advantages and disadvantages. Some candidates described their five options at length, one after the other, and then set out the advantages and disadvantages separately. They seemed to struggle more than those that included the relevant pros and cons alongside each description in turn. Similarly, candidates that clearly identified whether they were discussing (dis)advantages to the employer or the members generally made more points and scored more highly.

Many candidates mentioned one or more "alternative to contributions" (e.g. charge on assets, contingent contributions, invest in credit default swaps). Whilst one of the risks in (i) was the sponsor covenant, the examiners were not entirely convinced that these were all risk reduction options (rather they are risk mitigation), particularly as plenty of candidates were able to identify five of the options listed above. Credit was given, however, but only for one distinct option of the five required, regardless of how many variations candidates included.

Some candidates suggested entry to the PPF as a risk reduction option (often without further explanation). This may ultimately mitigate risk, but it seems unlikely to the examiners that the CFO would propose this, given that the insolvency of the company would need to happen first.

(iii)

- Trustees and employer have effectively agreed to "plan" to eliminate the current deficit and reduce investment risk over time
- the funding target, investment strategy, timescale etc are all inter-linked
- and these will need to be monitored fairly regularly
- so they can take the necessary actions if things do not go according to plan
- to maximise the likelihood of trustees and employer achieving the objective
- works best if plan of actions is agreed beforehand to know what to do if ahead of or behind target.

Target liabilities and funding position

- Need to decide what liabilities to target
- and how to set the basis for calculating these liabilities
- The buyout basis is the ultimate low-risk target
- because, if fully funded, trustees and company can remove their obligations to continue the scheme
- but likely to have the bigger deficit compared with the gilts basis
- A gilts basis may not be sufficiently low-risk, but in UK market likely to be more affordable than buyout
- because buyout will include margins for insurers' profits and expenses
- So gilts basis may be a more realistic target
- so that if/when fully funded and matched on this basis, can run the scheme as a "closed fund"
- where the trustees might no longer be heavily reliant on the company to continue to sponsor the scheme
- One option is to use low-risk assets such as gilts (minus a margin if target is buyout) to derive the discount rates
- Mortality basis might be derived by using latest available industry tables,
- or, given the large size of scheme, might have enough scheme-specific mortality data
- Aim is to eliminate the deficit
- so trustees and employer might aim to be 100% funded on buyout/gilts basis
- or higher (e.g. 105%) if they want to build in some contingency
- It might be difficult to aim to buyout precisely over the long term,
- because prices will vary over time due to changes in bond yields, desired profits and buyout market conditions
- so can only know liabilities when quotations are obtained from insurers
- but will be impractical to obtain quotes frequently.

Investment strategy

- Important ultimately to match assets with liabilities
- by value, duration and cashflows
- So, as the funding level improves to 100% or more,
- the allocation to equities will need to be reduced over time
- in favour of bonds (mainly gilts) that more closely match the liabilities
- What will the target investment strategy be at end of the period?

  - Will it be 100% gilts?
  - Or gilts + cash?
  - Swaps might be needed to match benefit cashflows more precisely
  - And need appropriate mix of nominal and inflation-linked bonds to match the fixed and real liabilities
  - *[no marks if candidates state that risky/growth assets might be used to match liabilities]*
- How will the scheme reduce risk in the assets over time?
  - De-risk method (1), "Mechanically" over time
  - ...where e.g. a fixed % of equities is sold each month or year until the target investment strategy is achieved
  - or, de-risk method (2), "dynamically" or "opportunistically",
  - ... where the scheme only sells risky assets to purchase gilts if "triggers" are breached
  - e.g. de-risk only if the funding level is ahead of expectations, or
  - e.g. de-risk if equities become expensive relative to gilts

Actions if funding position is better or worse than expected

If funding position worsens over time or is worse than expected, then:

- Trustees could extend the time horizon to reach the funding target, or
- Trustees could reduce risk in assets to avoid the funding level worsening further, or
- Trustees could ask the employer for extra contributions – which may be unaffordable given the size of the employer and the weak covenant, or
- The company could reduce benefits [max 1 mark]
  - e.g. cut future benefits by reducing accrual rate, or
  - offer an enhanced transfer value exercise for deferreds, or
  - provide members with the option of a pension increase exchange etc.
  - or see if support is available from overseas parent

If the scheme is ahead of their "plan" (i.e. funding level is higher than expected) then:

- The company might reduce contributions (so timescale unchanged)
- or trustees might de-risk the assets (sell equities, buy bonds/swaps)
- or trustees and company could share the "profits" and do a combination of both
- or trustees could leave assets unchanged, but shorten the timescale to get to full funding on the buyout basis
- or trustees could "settle" some of the liabilities, e.g. do a buy-in for some or all of the pensioners if bulk annuity prices are favourable.

Timescale

- length of recovery period to eliminate this deficit would need be based on the level of contributions that the employer can reasonably afford
- and will rely on the de-risking strategy employed – i.e. how quickly do they plan to have the assets match the liabilities

- so it is very likely to be fairly long due to
  - the size of deficit relative to the company,
  - the weak covenant
- but might need to change if the funding position is materially better or worse than expected
- so it might be shortened if there are favourable market conditions
- or it might be lengthened if the funding level worsens or is lower than expected, (unless the company provides a contingent funding arrangement)

Probability of achieving the objectives

- How can the trustees and company assess the chances of achieving the objective?
- Deterministic model might help, but has limitations
- If want a high probability of achieving objective, such a model might use prudent discount rates to calculate the liabilities
- and prudent investment return assumptions for calculating the return on current assets and future cash flows
- However, a stochastic model might help further to show the variability of future funding levels
- and this tool might help identify the chances of eliminating the deficit within any agreed timescale
- If stochastic model used, need to decide what "likelihood" to target
- E.g. company might only want to achieve objective with a best estimate (50%) chance,
- Or, given the very prudent funding target (i.e. buyout or gilts), then trustees might be relaxed with aiming for best estimate (50%) chance of achieving goal
- this would be more affordable for the employer
- Or trustees might build in some more prudence and aim for a higher than 50% probability
- In practice probably achieving this looks low given position of employer

This was question was not generally answered well, and few candidates scored more than half the marks available. Those that did almost certainly went on to pass the paper overall. It is much easier to score well by treating a question such as this as five sub-questions (each worth 4 to 5 marks), and try to make six to eight points under each heading (rather than hope that a solid slab of writing around the topic includes 30 or more distinct and relevant points).

In terms of the technical content of this question, few candidates appeared to consider the implications of the self-sufficiency / buyout target on the funding and investment strategy in sufficient detail and over the "long-term" as specified in the question. Some just focused on an immediate wind-up, severely limiting the scope of their answers. Again, candidates should note that the subheadings suggested a longer term "journey plan" was required.

2 (i) *The main purpose of choosing a mortality assumption would be the funding valuation but credit was given if candidate justified a different approach in particular circumstances (e.g. best estimate for costing benefit changes)*

- Pre-retirement mortality not normally significant for funding purposes...
- ...but post-retirement mortality is a key assumption in the calculation of liabilities
- TPR in its Code of Practice has stated that particular attention should be paid to this important assumption
- and need to consider the latest available relevant data on likely future mortality rates
- Best practice would suggest that the setting of the assumption should be evidence based
- scheme experience where statistically justifiable could be used
- or an adjustment made to a standard mortality table to reflect scheme characteristics, eg pension levels, geographical location
- and be clearly and transparently described
- e.g. not using an implicit adjustment to say the interest rate assumption to allow for effect of mortality improvements
- Adopt general principle of prudence for valuation assumptions for the valuation basis as a whole
- and reflecting the strength of the employer covenant
- The assumption needs to consider an appropriate "base" mortality table
- bring the table up to date
- and allow for future improvements in life expectancy

Many candidates did not appear to have read the whole question first, for example, including detail appropriate to part (iv) in their answer to part (i). The examiners were flexible in awarding appropriate credit in this case, but candidates should understand that it can give the impression that they have not planned their answers well.

Most candidates recognised the importance of mortality assumptions, but missed out on some of the basic principles above.

(ii)

- Only appropriate for very large pension plans with good data
- e.g. 5,000 or more pensioners
- Would have to start with a scheme specific statistical analysis around the actual death experience
- But still need to update the experience to valuation date
- Non pensioner population is unlikely to permit a study with any credibility
- So unless the deferred population is markedly different to pensioners then the same baseline table could be adopted
- The choice of future improvement will be more critical in assessing deferred member liability than a minor change in the baseline table
- Allow for any know changes in membership profile (eg switch from industrial to clerical)

Very few candidates answered this question thoroughly.

(iii)

- This methodology has been used by some life offices as a rating factor for pricing annuities for some time
- Socio-economic factors such as housing, healthcare, education and diet are believed to influence a person's life expectancy
- ...and a person's postcode acts as a proxy for this information
- Postcode analysis is now more widely available to pension schemes
- So the pension scheme does not have to rely solely on pension size and broad geographical location as rating factors
- Although use of postcodes will not be able to distinguish people travelling from overseas for example
- Postcodes may be able to uncover underlying demographic factors that can be expected to be associated with life expectancy rather than just "high level" geographical rating factors
- This method satisfies the requirement of "evidence based" analysis required by TPR
- and is possible to use it for schemes that would have insufficient data to look at the number of deaths they have experienced over past years
- The results allow a suitable adjustment to be made to a standard baseline mortality table
- Allowance for future mortality improvements is still needed
- Which may also be postcode based?
- Downsides include
  - Extra data needed for analysis
  - More time consuming (leading to increased adviser costs)

This question seemed to divide candidates into those that scored very well and those that appeared to have little or no knowledge of the use of postcodes or rating factors in general (and who were unable to even make any points from first principles).

(iv) Possible approaches include:

- Scheme specific future improvements may be allowed for
- perhaps using a time based trend analysis
- However wider based studies of future improvements are more likely to be used
- Process based projections attempting to model trends in causes of death
- There are practical problems associated with this method e.g. death classification and insufficient understanding of major causes of death
- Extrapolative methods projecting historical trends in mortality into the future
- Includes some element of subjective judgement
- Use of mortality improvements by year of birth or "cohort"
- Initially CMIB published a selection of three cohort projections (Short, Medium & Long)
- with future improvement tailing off over three different periods
- CMIB projections updated annually – CMI core projections

- Use of an underpin to the projection increasingly common
- e.g. a 1% p.a. minimum improvement, which addresses the tailing off feature of the projections
- Important that Trustees understand that future levels of improvement are uncertain
- Stochastic approaches could be used
- looking at a range of different scenarios with attaching probabilities
- Examples include P Spline and Lee Carter Methods

Most candidates gave good answers to this question, although there were a few that appeared to have little or no knowledge beyond the "cohort" approach.

(v) (a) Key features

Longevity Swaps

- The fund continues to pay the pensions to the pensioners
- but the swap provider makes matching payments to the trustees
- In return the fund agrees to pay a series of fixed payments to the swap provider
- If the pensioner lives longer than expected the fixed payments stop but the swap provider still makes payments to the fund
- There is no upfront cash payment
- But may be requirement to post collateral
- Generally only covers pensioners
- but index contracts for non pensioners are now available
- however are relatively expensive compared to the ongoing funding reserve

Immediate and deferred annuities

- An insurance policy is purchased to extinguish the pension liability
- Future pension payments are (usually) paid directly to the pensioner by the insurance company
- The insurance policy may be purchased in the pensioner's name
- Generally a single up front lump sum is payable to the insurance company
- Immediate annuities are purchased for pensioners
- and deferred annuities are purchased for non pensioner members
- Likely to be more expensive than ongoing funding, particularly deferred annuities
- Due to profit/expense loadings and reserving requirements
- But competitive market for immediate annuities may give rise to opportunities

(b) *Mitigation*

Longevity swaps

- The fund has bought certainty over the cash flows to pensioners
- The transformation to fixed payments removes the baseline and future mortality improvement risk
- It does however introduce a counter party exposure

- Also there is basis risk if the pensioner mortality experience doesn't match that of the underlying index of the swap (e.g. if our pensioners live a lot longer than those in the population on which the index is based)

Immediate and deferred annuities

- The mortality risk is completely removed from the scheme
- and transferred to the insurance company
- for deferred members and pensioners
- There is still a potential contingent liability if the insurer fails

Most candidates answered part (v) well.

3 (i) *A cap of 1% per annum to be imposed on the rate at which pensionable salaries may increase from 1 January 2012*

- Based on current design, current value of benefits at 62 is: $27/60 * 20{,}000 * (1+\text{sal incs})^{12} * (1+\text{discount rate})^{-12} *$ annuity at 62
- The change will affect benefits accrued both before and after 1 Jan 2011
- Under new design current value of benefits at 62 is: $27/60 * 20{,}000 * (1+\text{sal incs}) * 1.01^{11} * (1+\text{discount rate})^{-12} *$ annuity@62

  So percentage change is: $1 - (1+\text{sal incs}) * 1.01^{11} / (1+\text{sal incs})^{12}$

- Assume that 4% per annum is a suitable assumption for salary increases
- Then percentage change is $1 - (1.04 * 1.01^{11} / 1.04^{12})$
- A decrease of 28%

Credit was given for other sensible salary increase assumptions.

The normal retirement age of the scheme to increase from age 62 to age 65 for benefits accrued after 1 January 2012

- The benefits accrued to 1 January 2012 will be unchanged
- Current value of benefits accrued to 1 January 2012 before and after change in design
- $= 16/60 * 20{,}000 * (1+\text{sal incs})^{12} * (1+\text{discount rate})^{-12} *$ annuity at 62
- Current value of benefits accrued from January 2012 before change in design
- $= 11/60 * 20{,}000 * (1+\text{sal incs})^{12} * (1+\text{discount rate})^{-12} *$ annuity at 62
- Current value of benefits accrued from January 2012 after change in design
- $= 11/60 * 20{,}000 * (1+\text{sal incs})^{12} * (1+\text{discount rate})^{-12} *$ annuity at 62 * ERF
- (where ERF is an early retirement factor to reflect retiring 3 years early)
- So percentage change is $1 - ((16 + 11 * \text{ERF}) / (16 + 11)$
- Assume early retirement factor is cost neutral
- So can be found by using:

- ERF * annuity at 62 = annuity at 65 * ((1+sal incs)/((1+discount rate))^3
- Assume 6% per annum is a suitable discount rate assumption
- And 4% per annum is a suitable assumption for salary increases, as above
- Assume that the annuity decreases by 2.5% per annum for each year increases in age
- Then ERF = 1.025–3 * $(1.04/1.06)^3$ = 0.88
- Percentage change in benefits = 1–(16 + 11 *0.88)/(16+11)
- A decrease of 5%

Credit was given for other sensible assumptions/approaches.

(ii) *Members receive a lump sum of 3 times gross salary on ill health instead of a temporary pension based on potential service to age 62*

- Current value of ill health pension payable up to age 62 before change to design is:
  probability of becoming ill * (62 – 50 + 15)/60 * gross salary when becomes ill * annuity at age becomes ill until age 62
  * $(1 + \text{discount rate})^{-\text{time until becomes ill}}$
- Current value of ill health benefit after change to design is:
  probability of becoming ill * 3 * salary when becomes ill *
  $(1 + \text{discount rate})^{-\text{time until becomes ill}}$

- So percentage change is: 1 – (3 / (27/60 *annuity at age becomes ill until age 62))

- One approach is to assume that if member becomes ill, he does so 2/3 of the way between now and age 62, i.e. age 58
- Then ill health pension payable for 4 years so annuity at age becomes ill until age 62 will be approximately 3.8
- So change in current value of benefit is (3 / (27/60 *3.8)) – 1
- i.e. 75% increase.

- Alternatively could consider position if member became ill the day after the change
- Then temporary pension payable for 12 years so annuity more like 10.5
- So change in current value of benefit is (3/(27/60 × 10.5)) – 1
- i.e. 37% decrease

There were various methods that candidates could have used to answer this part and credit was given to those who covered the extra complexity in a solution that allowed for the post age 62 pension.

Credit was given for other sensible assumptions/approaches.

Part (i) was generally well answered, and the examiners recognised that appropriately annotated shorter solutions also merited full marks. Some candidates, however, produced much lengthier calculations than those above, which must have eaten into their time to complete the remainder of the question.

Common mistakes were not spotting that the comparison in part (i) was to be done on the basis that the member retires at age 62, and also that the changes would apply from one year after the effective date.

Part (ii) was less well answered, with very few candidates appreciating how crucial the point at which the member becomes ill is to the comparison. Whilst the "2/3 of the term" approach is a common funding approximation, it may not be appropriate to simplify in this way when identifying individual winners and losers for a benefit change.

(iii) (a) The actuary will need to make the following assumptions:

- Ill health decrement (probability of members becoming ill at each age)
- Will depend upon how severe ill health needs to be to claim benefit
- Separate scales for miners/management/clerical staff?
- Impaired-life mortality to calculate the value of the pension benefit
- Discount rate to determine present value of alternative payments
- Inflation/pension increases, to value temporary pension
- Salary increases assuming uplift to be a % of salary
- Decrement tables to determine members' expected remaining career length
- E.g. normal health early retirements, deaths and withdrawals

(b)

- Employer/member will have conflicting wishes as different approaches will affect amount of extra salary paid
- The actuary may use a best estimate as this may be seen to balance the needs of the company and employees
- Or the scheme's funding basis so that the contributions required from the company remain stable
- Could use an insurance-type basis
- …this is most likely to enable members to purchase equivalent protection benefits elsewhere should they wish to
- …but would be most expensive for the company
- However, the uplift will not bite for older members so total cost may not be great
- Take into account how much members value the protection benefit
- …are they likely to purchase insurance elsewhere or would they prefer cash?
- Need to consider assumption for members' expected remaining career carefully, since any uplift actually received will be sensitive to this
- Assuming members remain in service until age 62 will minimise payments, but is this realistic?
- …and assuming too short an expected remaining career will overstate the amount that members will need as compensation and reward early leavers.

Part (iii) was not generally answered well overall, albeit with part (a) typically answered reasonably well. The better candidates included why specific assumptions were relevant to

the calculation in (a). Few candidates used the stakeholders involved, and their interests, to analyse the issues for part (b). Some candidates appeared to treat this as a standard (past?) question about how you might derive each valuation assumption.

(iv)

- Members are likely to welcome the change from 3*salary to 4*salary
- …and the comparison with the old benefit
- …especially if it means they will receive more salary
- Which will increase pension
- But members are unlikely to understand the "best of" calculation
- Being in a dangerous job, members may value the certainty of knowing they have an ill health pension
- But will the salary uplift be sufficient to provide the security of the old benefit together with the 4*lump sum?
- Members are unlikely to be financially aware enough to invest lump sum to provide sufficient income
- …or to understand how much income 4*salary could provide until normal retirement age
- Will be expensive for miners to obtain income protection
- …especially for any workers with existing medical conditions who will value the benefit the most
- The uplift will not bite for all members
- this may cause resentment where employees do not receive a salary uplift and see others doing so
- Some members will be better off under the lump sum benefit, but may not realise this unless it is explained carefully
- Also, members with dependants are more likely to value the pension (assuming dependants' benefits paid)
- Tax treatment of alternatives may be different
- Members generally prefer cash
- Older members may value change more highly than younger members

Better candidates scored well by logically thinking through the key drivers of the potential winners and losers, and recognising that the complexity would require some form of financial advice for most members. Some candidates analysed the full range of proposals, apparently missing the reference to "this revision" in the question.

END OF MARKING SCHEDULE