

# **EXAMINATION**

8 November 2010 (am)

**Subject F104 — Pension and Other Benefits**  
**Principles**

**MARKING SCHEDULE**

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### **General comments:**

This was not a difficult paper, and there were many bookwork marks available. Candidates appeared to be unprepared to respond properly to these questions, and therefore lost marks.

In questions that required some insight or broader thought, candidates struggled to generate enough ideas to gain maximum marks.

Most candidates seemed completely unprepared for a large calculation question, and did not know how to approach it.

### **Question 1**

**This was a theory question and was answered reasonably well. Many students did not define the terms, despite this being explicitly asked for in the question. Many candidates did not understand the concept of ‘realism’.**

Pay as you go = PAYG, Terminal funding = TF, Just-in-time (JIT)

PAYG is where the sponsor only makes payments when payments to beneficiaries are due. TF is where the full value of future expected payments is made whenever a benefit starts to be paid. JIT is where payment is made at the last possible moment – when an external event jeopardises the security of the fund.

Stability – the ability of a funding method to produce a contribution rate which is not unduly distorted by fluctuations in experience. PAYG – stable if outgo is stable – level of benefit relatively uniform and retirement ages do not vary significantly between individuals. TF-stability depends on the timing of retirements. JIT operates effectively as PAYG, but external influence may affect the stability of the contribution rate.

Security – the ability to meet benefit expectations in all circumstances.

TF most secure for benefits in payment, but not secure for those not yet retired. PAYG offers no security – unless organisation or govt underwriting benefit promise is guaranteed to continue existing. JIT – more secure than PAYG if the external event occurs and the funds are available to fund benefits. Otherwise – not secure – as per PAYG.

Realism – to be realistic, the cost should relate to the accrual of benefits over the given period.

PAYG can give rise to unrealistic impression of pension costs in the short term – long-term costs may be unsustainable, even if s.t. are acceptable. TF not realistic as not showing cost year on year as they accrue. JIT – as per PAYG, unless external event occurs, but then effectively TF.

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## Question 2

**This question was reasonable well answered. Most candidates ignored the funding level and so missed out on marks relating to the possible treatment of the surplus. Many candidates also failed to provide revised ranges, as asked for in the question.**

### Solution 2

- i)
  - Prob that individuals are eligible to accrue benefits
  - Prob that individuals are eligible to receive benefits
  - Effect of inflation on level of benefits
  - Investment return
  - Tax treatment\
  - Loss of funds due to fraud
  - Incorrect benefit payments
  - Inappropriate advice
  - Administrative costs
  - Fines or removal of tax status
  - Decisions by parties to whom power has been delegated
- ii) - Issues in the DB to DC conversion
  - o Investment risk moves to the member
  - o This means great care needs to be taken in investment choices – as members carry consequences and not sponsor
  - o Members also lose certainty of benefit levels – will want maximum returns
  - o Investment fees also carried by members
  - o Investment choice to be given to members? Members may want this, but requires greater levels of communication and adds to admin complexity – could affect costs.
  - o Any special investment decisions to be made for those close to retirement? Will market related investments be appropriate when nearing retirement? Perhaps consider capital protection at this point.
- Issues from the funding level
  - o How will extra assets be invested?
  - o Will these be free assets or allocated to members at conversion? If free assets, more liberty as to choice of investments.
  - o How realistic is the basis? If conversion on a best estimate basis, what happens to the funding level?

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- Issues around the pensioners
  - o Currently paid from the fund. In the DC arrangement if this were to continue there would still be risks to the sponsor of having to make additional contributions in respect of these, although the funding level reduces the likelihood of this.
  - o Possibly consider an outsource of the pensions via immediate annuity purchase.
  - o If purchase, what level of increases to be allowed for? What would pensioners expect?
  - o How does cost of outsource compare to level of assets held in respect of the pensioners?
- Possible ranges
 

|                                   |           |
|-----------------------------------|-----------|
| o Insurance policy iro pensioners | 40% - 50% |
| o Equities                        | 30 – 40%  |
| o Fixed interest                  | 10% - 20% |
| o Cash                            | 0% – 5%   |
| o Foreign equities                | 5% - 10%  |

### Question 3

**This question was poorly answered despite being largely a bookwork question. For part (i) many candidates explained PAYG, but the question stated that the systems would be partially or fully funded. Part (ii) was particularly poorly answered. Most candidates struggled to generate a number of practical considerations for part (iv).**

### Solutions 3

i)

General Average Premium (GAP)

contribution is set such that a level of rate will be payable throughout the lifetime to the scheme – relatively high upfront. The contribution rate is stable if the assumptions are borne out in practice.

GAP contribution rate = ( pv of all future benefit expenditure (incl that arising from future new entrants) / (pv total salaries of contributing population in all future years (incl future new entrants)

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## Terminal Funding

Contribution rate required for any period is the amount required to finance the capital value of benefits awarded in that period – i.e. benefits are prefunded at the time they are awarded.

Contribution rate = (pv of benefits awarded in year t) / (pv of total salaries of the contributing popn in year t)

## Scaled premium

Similar to an equalised PAYG rate, but the fund is not allowed to fall below zero. Example – use a long control period (say 20 years) for the equalised contribution rate

I.e (pv of benefit paid over the 20-year control period)/(pv of salaries paid over the 20-year control period)

Recalculate when fund starts to fall

- ii) - Can use PV or Projection methods – usually projection in social security schemes.
    - Calculation based on population effects – not actual membership data
    - Unlikely to have individual data – will make projections at popn level
    - Projections usually allow for future new entrants
    - ‘Membership’ not affected by changes to employers etc. – only in who is eligible, and for what benefit, and what contributions people may pay in.
    - Need to project population size – can use exponential and logistic methods (include formulae)
    - Then need estimate of :
      - o Proportion of population who are contributors
      - o Proportion of the population who are beneficiaries
      - o Contributory salary of contributing members
      - o Amounts of benefits payable to different categories of beneficiaries
    - These must be split between appropriate population subgroups
    - Benefit (pension) expenditure can be projected using the factor method or the survival method:
      - o Factor method
- Pension expenditure at start of year t for those aged x :
- $$P(x,t) = l(x,t)k(k,t)a(x,t)$$
- Where  $l(x,t)$  = popn aged x at time t
- $k(x,t)$  = proportion of popn aged x receiving a pension at time t
- $a(x,t)$  = average amount of pension for those aged x at time t

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Total projected annual pension expenditure in year t

$$= 0.5 \times \sum_x P(x, t) + 0.5 \times \sum_x P(x, t + 1)$$

o Survival method

Calculate pension awards in each future year:

Total awards of pension in year t = (no of people in the popn reaching age in year t) x (prop of popn reaching pension age who are entitled to a pension) x (full pension rate in year t) x (average prop of full pension rate received)

$$P(x, t) = P_{9x-1, t-1} (1+i)^{t-1} l(x, t) / l(x-1, t-1)$$

The pension cost in year t is as above.

Projected future contribution income is calculated as

$$= \sum_x \sum_i R_i l(x, t) c_i(x, t) y_i(x, t)$$

Where  $R_i$  = contribution rate in class i

iii) Assumptions:

- o Mortality improvements
- o Future fertility
- o Future migration
- o Price inflation
- o Earnings inflation
- o Rate of pension increases
- o Contribution earnings limit increases
- o Economic activity rates
- o Invalidity rates
- o Age of retirement
- o Perhaps assumed rate of return on fund – if funded

iv) Practical considerations:

- o Complexities and decisions around the benefit design
- o What will happen to any existing arrangements? For example private provision that may be in place? Will benefits be integrated, and how?
- o Compulsory membership or can you contract out?
- o What will happen if already giving tax relief on private provision?
- o Where will any additional financing come from?
- o How will the transition arrangement work? There is currently no fund for these benefits, how is it envisaged to build up this fund?

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## Question 4

**This question was well answered.**

- i.)
  - Continuation of scheme without further accrual of benefits
  - Transfer of liabilities to another pension scheme with the same sponsor
  - Transfer of funds to the beneficiary – extinguish the liability
  - Transfer the funds to an insurance co to invest and provide the benefit
  - Transfer the liabilities to an insurance co to invest and guarantee the benefits
  - Transfer the liabilities to a central discontinuance fund, operated on a national or perhaps industry-wide basis
- ii.) Benefits outsourced
  - Guarantee current benefit levels – pensions not to be reduced
  - What to do with pension increases? Must be included in the purchase, as fund will be discontinued. What level of increase can be afforded?
  - Fixed increases versus related to an index – eg CPI.
  - Annuities must match benefit promised by fund – spouse’s pensions, guaranteed periods etc. Does such an immediate annuity exist?
  - Insurer will charge for the benefit being guaranteed – need to fund this.
  - Also, administration charges in respect of all future benefit payments will be included in the purchase price of the annuities – also need to be funded.
  - Can the fund afford this?
  - What assets will be used to pay for the annuities? Cash available? Or disinvest at potentially non-optimal terms.
  - Security of benefits – selection of insurer important, as pensioners now subject to default of insurer, and have no other sponsor.
  - Compliance with legislation regarding the outsource is important.

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## Question 5

**In general, this question was poorly answered, with candidates being unable to generate sufficient different considerations. The issue of the voluntary membership of Fund X was largely ignored, thus limiting the number of points a candidate was able to generate.**

Answer can be split between sponsor and trustees.

Benefit levels:

- Benefits of Fund X to be changed to that of Fund A
- Change to benefit structure only in respect of future accrual – past benefits must be guaranteed, but future service need not be
- What Fund X benefits higher, how will employees be compensated for accepting reduced benefits?
- If Fund X benefits lower, will Company A be willing to fund higher contributions for Company X staff?
- Will membership of Fund A be compulsory to staff from Company X? If so, this may mean a reduction in take home pay for staff not currently on Fund X. How will this be compensated?
- Are there pensioners on Fund X? What increases do they enjoy and expect? How does this compare to Fund A?
- Will annuities be purchased for these pensioners?
- Employer will probably want all staff on one fund/benefit structure – especially as Company X is small relative to Company A.

Valuator's considerations:

- Are there sufficient assets in Fund X to cover the liabilities?
- Cannot accept full liability if not fully funded, as jeopardises the security of existing Fund A members
- On what basis is the funding level calculated? (Optimistic, conservative or best estimate)
- Compare basis of 2 funds. If Fund X is weak basis, may need to achieve equalisation of benefits into Fund A by reducing years of service, and vice versa if basis of Fund X is stronger than that of Fund A.
- Communication of the transfer of existing members into Fund A will be critical.
- What are the assets of Fund X? Are these being transferred – or is there cash to transfer? Are the assets and liabilities appropriately matched?

General:

- What legislation governs a transaction of this nature?

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## Question 6

**This was not a difficult question, and was not answered very well by many candidates, with most answers being too short and candidates not being able to generate a large number of different factors to consider for part (i). Most candidates did not understand the concept of ‘consistency.’**

- i.) Consider from perspective of employer:
- DB fund – benefits defined in advance – known – wrt salaries and service
  - DB – costs not known in advance – final cost only known at the end of the life of the fund when the last benefit payment is made – area of uncertainty for employer. Vary with scheme experience – not in employer’s control
  - DB – member usually pays fixed premium, employer pays balance of all costs
  - DB - employer, as the sponsor, carries all risks – investment returns, inflation – salary increases
  - DB - Usually funded in advance
  - DB – cost of compliance with legislation
  - DB – can aid employment policy – for example enhancement of retrenchment benefits, reward long-serving employees
  - DB – more difficult for members to understand
  - DB – benefits for high flyers keep pace with promotion and merit increases
  - DC fund – contributions defined in advance – member and employer usually both contribute
  - DC – benefits not known in advance – benefit is the accumulated value of the contributions with investment returns – less any costs – benefit determined by form of benefits and cost of any purchase
  - DC – costs known – contribution rate defined in advance
  - DC fund – no contribution flexibility
  - DC fund – usually subjected to fewer regulatory restrictions
  - DC fund – risk of poor benefit levels
  - Dc fund –all risks fall to the members
  - DC fund – easier for employees to understand and appreciate
  - DC - Potentially better benefits for early leavers.
  - DC – may offer more flexibility to members

- ii.) Consistency – ensuring that benefits for the same contingencies are consistent example from one age to the next, and irrespective of whether insured or paid from the fund.

Example – death benefits pre- and post- retirement should be consistent – so the benefit should someone die just before retirement should be similar to the death benefit just after retirement. Also, a disability in service benefit should be consistent with an ill-health early retirement benefit.

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## Question 7

**Very poorly answered question. The question was not easy, and required candidates to know how to calculate contribution rates quickly – many candidates used the theoretical formula which wasted much time. Credit was given where candidates made simplify assumptions about timing of cash-flows, or in general. Part (iii) was particularly poorly answered, with few candidates attempting to do the analysis with numbers. Most merely repeated the points 1. – 3. that were given to them in the question regarding the sources of the surplus or deficit arising.**

### **Solution 7 (rounding at the end only)**

i) PU contribution rate =  $5740 / 1647.38 = 0.2870$

AA contribution rate =  $7237.3 / 21100 = 0.343$

Average age of actives at 31 January 2007 = 48 therefore 17 years to NRA

$(1.07/1.09)^{14} = 0.771617229$

$(1.07 / 1.09)^{17} = 0.729917466$

Average service at 31 January 2007 =  $4\,597\,129 / 2\% / 14.681 / 1950\,000 / 0.729917466$

= 11 years

Average service at 31 January 2010 = 14 years

Assume pension liability at 31 January 2007 allows for pension increase at that date. Therefore pension payment for 2007 =  $1375000 / 12.354 = 111300$ . Assume pensions paid in advance. (Can adjust if paid monthly – assume ½ way through the period)

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| Year | Pension payment out            | Salaries (7% increase pa) ('000) | AA cons in net of expenses     | Net income                       |
|------|--------------------------------|----------------------------------|--------------------------------|----------------------------------|
| 1    | 111,299.98                     | 1,950.00                         | 601,965.00 (=0.343 * salaries) | 490,665.02 (cons – pension pmts) |
| 2    | 116,308.48 (= year 1 * 1.045)  | 2,086.50 (=year 1 *1.07)         | 644,102.55                     | 527,794.07                       |
| 3    | 121,542.36 (= year 2 *(1.045)) | 2,232.56 = (year 2 *1.07)        | 689,189.73                     | 567,647.36                       |

|   | Net cons on AA | Accumulation at |
|---|----------------|-----------------|
| <b>Asset projected to 31 January 2010</b> |                | <b>9.00%</b>    |
| Net contribution in year 1                | 490,665.02     | 635,425.43      |
| Net contribution in year 2                | 527,794.07     | 627,072.13      |
| Net contribution in year 3                | 567,647.36     | 674,421.83      |
| Total accumulated net cons                |                | 1,936,919.39    |

Expected surplus =  $7\,840\,000 \times (1.09)^3 + 1\,936\,919.29$

-  $4\,597\,129 / 0.729917466 * 0.771617229 / 11 * 14 / 1\,950\,000 * 2\,232\,555 \times (1.09)$

-  $1\,375\,000 / 12.354 * 9.721 * (1.045^3)$

**= 12 089 946.75 – 7 577 074.11 – 1 234 681.43**

**= R 3 278 191.21**

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ii)

| Year | Pension payment out | Salaries ('000) | PU cons in net of expenses | Net income |
|------|---------------------|-----------------|----------------------------|------------|
| 1    | 111,299.98          | 1,950.00        | 503,685.00                 | 392,385.02 |
| 2    | 113,859.88          | 2,086.50        | 538,942.95                 | 425,083.07 |
| 3    | 116,478.66          | 2,232.56        | 576,668.96                 | 460,190.30 |

| Net cons on PU | Accumulation at |
|----------------|-----------------|
|                | 8.21%           |
| 392,385.0162   | 508,149.9751    |
| 425,083.0666   | 505,041.1914    |
| 460,190.2957   | 546,752.0904    |
|                | 1 559,943.257   |

Actual surplus

$$\begin{aligned} &= 7\,840\,000 \times (1.0821)^3 + 1\,559\,943.257 \\ &- 4\,597\,129 / 0.729917466 * 0.771617229 / 11 * 14 / 1\,950\,000 * 2\,232\,555 * (1.09) \\ &- 1\,375\,000 / 12.354 * 9.721 * (1.045^3) \\ &= 11\,493\,808.26 - 7\,577\,074.11 - 1\,158\,331.71 \\ &= \mathbf{R\ 2\,758\,402.44} \end{aligned}$$

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iii)

Gain due to lower pension increases =  $1\,234\,681.43 - 1\,158\,331.71 = 76\,349.72$

Loss due to lower investment returns =  $490665.0162 \cdot (1.0821)^3 + 530242.6666 \cdot (1.0821)^2 + 572711.0677 \cdot (1.0821) - 1\,936\,919.36$

+  $7\,840\,000 \cdot ((1.0821^3 - 1.09^3))$

=  $1\,862\,322.40 - 1\,936\,919.36 - 219\,162.36$

=  $-293\,759.35$

Loss due to lower contributions

=  $1\,559,943.257 - 1\,862\,322.40$

=  $-302\,379.14$

Items explained =  $76\,349.72 - 293\,759.25 - 302\,379.14 = -519\,788.77$

Actual surplus – expected surplus =  **$2\,758\,402.44 - 3\,278\,191.21 = -519\,788.77$**

iv.

- Funding method does not impact costs directly
- Pace of funding affected by choice between AA and PU
- AA funding on average for all future service accrual
- PU aiming to pay the cost of the benefits accruing in the next 3 years, over the 3 years
- AA – higher contribution rate now, but expected to be stable as membership ages
- PU – lower contribution rate, but expected to increase with increasing age of membership
- AA may be appropriate here as little or no turnover of staff – fund expected to age
- Ultimate cost of db benefit will only be known once last pension payment has been made