MAS224, Actuarial Mathematics: Problem Sheet 1

*Post your solutions to the starred questions in the **orange box** on the **second floor** of the Maths building by **12 noon on Monday, 21th January 2008**. Do not forget to staple all pages together and write your name at the top of the front sheet.*

Give accumulations of money to the nearest penny and all other numerical answers to 4 decimal places. Interest rates should be given as percentages.

1*. A bank credits interest on deposits monthly at rate 0.5% *per month*. What is the nominal interest rate (per annum) for interest compounded monthly? Find the corresponding annual effective rate of interest.

2*. Interest on certain deposits is compounded weekly. The AER is 15%. Find the nominal rate of interest per annum. Obtain the accumulation of an investment of £5,000 over a period of 13 weeks.

3*. If the force of interest δ is 0.2, obtain the nominal rate of interest (per annum) when interest is compounded (a) annually, (b) quarterly, (c) monthly, and (d) daily.

4*. Assuming constant force of interest, find the AER if an investment of £10,000 doubles over a period of five years.

5*. A man wishes to borrow £10,000 for two years and to repay the loan plus interest at the end of the two years.

Bank A charges interest on loans *weekly* at the nominal rate of 11% *per annum*. Bank B charges interest on loans *quarterly* at the rate of 3% *per quarter*. Bank C charges interest for the first six months with an AER of 3% and for the remaining period with an AER of 15%.

In each case calculate the amount payable at the end of the two year period. Which bank would you choose for your loan?

6*. The force of interest depends upon the time (in years), t, with $\delta(t) = 0.05$ for $0 \leq t \leq 2$ and $\delta(t) = (0.05)(t-1)$ for $2 \leq t \leq 4$. Find the accumulated amount after four years from an initial investment of £1000 at time zero.

7. Assume constant force of interest δ. Show that (a) the nominal rate of interest $i^{(p)}$ decreases when the frequency of compounding p increases; and (b) $i^{(p)} = \delta$ in the limit $p \to \infty$.

In part (a) you may use the inequality $e^{-x} > 1 - x$ which holds for $x > 0$ without proof, and in part be you may find L'Hopital's Rule helpful.