STAT 472, Test 1, Fall 2007

Assume uniform distribution of deaths over each year (UDD) whenever necessary to answer the question. You must indicate each time UDD is used! Be careful: saying that you need UDD when you don't will be penalized.

Notation: T(x) is the time until death at age (x), K(x) = [T(x)] is the years until death at age (x).

(1) Below is a life table for female jubb-jub birds. Write an *explicit* expression that computes the following quantities for members of this group, assuming that $\delta = .03$. **Do not evaluate the expression.** Thus, for example if the question were to compute $_2E_1 + _1E_1$, the answer would be " $e^{-2(.03)} \frac{25}{200} + e^{-.03} \frac{75}{200}$ ".

(x)	l_x
0	300
1	200
2	75
3	25
4	10
5	0

- (a) The single payment pure premium for an insurance policy issued at age 2, payable at the end of the year of death, which pays \$1 if death occurs in the first two years, \$2 if it in the third year, and \$3 if it occurs occurs any time thereafter.
- (b) The expected remaining years of life (curtate expectancy of life) of a 2 year old.
- (2) Given that $\delta = .05$ and $l_x = \frac{1}{1+x^2}$, find an explicit expression for the following quantities. You may leave all sums and integrals unevaluated.
 - (a) μ_x (the force of mortality)
 - (b) The single payment pure premium for a 15 year term insurance policy issued at age 25 paying 1 at the time of death.
 - (c) The complete expectation of life of an individual aged 25.

- (d) The actuarial present value of a continuous whole life annuity paying 1 issued at age 25.
- (e) $P(e^{T(25)} \ge 20)$.
- (3) Use the Illustrative Life Table at the end of the exam to find (assuming that i = 0.06):
 - (a) Var(Z) where $Z = \nu^{T(40)}$
 - (b) Var(Y) where $Y = \overline{a}_{|\overline{T(40)}|} = \frac{1-\nu^{T(40)}}{\delta}$.
 - (c) The single payment pure premium of a 10 year \$500 term policy, payable at the end of the year of death, issued to a 40 year old.
 - (d) The actuarial present value of a 10 year temporary annuity that pays 1 at the beginning of the year sold to a 40 year old. *Hint:* The answer to the preceding question might be useful.
- (4) We have issued \$500 whole life policies, payable at the time of death, to each of 100 independent lives at age 40. Assume that i = .06 and that the survival function for each of the lives is described by the Illustrative Life Table at the end of the test. Use the normal approximation, together with the table of the normal distribution at the end of the exam, to approximate the size of the fund necessary to have on hand in order to be 97.5% certain of being able to pay any claim. *Hint:* Use some of the data computed in Problem 3.