1. Do problems 5.11, 5.12, 5.13, 5.31, and 5.51 from the textbook.

2. (Fall 2000, #35, SOA) For a special 30-year deferred annual whole life annuity-due of 1 on (35):
   (a) If death occurs during the deferral period, the single benefit premium is refunded without interest at the end of the year of death.
   (b) $\bar{a}_{65} = 9.90$
   (c) $A_{35:30} = 0.21$
   (d) $A_{1:35:30} = 0.07$
   Calculate the actuarial present value of this special deferred annuity.

3. (Fall 2004, #11, SOA) Your company is competing to sell a life annuity-due with an actuarial present value of 500,000 to a 50-year old individual.
   Based on your company’s experience, typical 50-year old annuitants have a complete life expectancy of 25 years. However, this individual is not as healthy as your company’s typical annuitant, and your medical experts estimate that his complete life expectancy is only 15 years.
   You decide to price the benefit using the issue age that produces a complete life expectancy of 15 years. You also assume:
   (a) For typical annuitants of all ages, mortality follows de Moivre’s law with the same limiting age, $\omega$.
   (b) $i = 0.06$
   Calculate the annual benefit that your company can offer to this individual.

4. (Sample Question #25) Your company currently offers a whole life annuity product that pays the annuitant 12,000 at the beginning of each year. A member of your product development team suggests enhancing the product by adding a death benefit that will be paid at the end of the year of death.
   Using a discount rate, $d$, of 8%, calculate the death benefit that minimizes the variance of the present value random variable of the new product.

5. (Sample Question #55) For a 20-year deferred whole life annuity-due of 1 per year on (45), you are given:
   (a) Mortality follows De Moivres law with $\omega = 105$.
   (b) $i = 0$
   Calculate the probability that the sum of the annuity payments actually made will exceed the actuarial present value at issue of the annuity.