

Show all work for full credit, and use correct notation. Simplify answers completely. Unless told or implied otherwise, assume all lives are independent. See reverse side for additional problems.

1. You are given:

- (i) The survival function for 20-year old males is ${}_t p_{20} = \left(\frac{60-t}{60}\right)^2$
- (ii) 40-year old females have a constant force of mortality of $\mu = 0.04$.
- (iii) ${}_{30}q_{20:40}^1 = \int_0^{30} g(t) dt$ where (40) is female and (20) is male.

Determine $g(10)$.

2. You are given:

- (i) The survival function for 20-year old males is ${}_t p_{20} = \left(\frac{60-t}{60}\right)^2$
- (ii) Newborn female mortality follows a uniform distribution over the interval (0,100)

Determine ${}_{30}q_{40:20}^2$ where (40) is female and (20) is male.

3. The force of mortality for smokers is $\mu = 2$, and the force of mortality for non-smokers is $\mu = 1$.

Determine the difference ${}_2q_{x:y}^1 - {}_2q_{x:y}^2$ where (x) is a smoker and (y) is a non-smoker.

4. For 25-year old males and 30-year old females, you are given:

- (i) $\mu_{25}(t) = 0.2$ for $0 \leq t \leq 10$
- (ii) ${}_tq_{30} = 0.01t$ for $0 \leq t \leq 10$

Determine the probability that a 30-year old female will die before a 25-year old male and within the next five years.

5. For a common shock model with $\lambda = 0.01$, in the absence of the shock the future lifetimes of (x) and (y) follow constant force models with $\mu_x^* = 0.01$ and $\mu_y^* = 0.08$. Determine the probability that (x) dies before (y) .