Soc 756
Problem Set 3

1. Approximately 85,000 adolescents turn 16 each year in Wisconsin. Data from Fohr et al., 2005 suggest that the probability of being involved in a non-fatal motor vehicle accident among Wisconsin 16-year-olds is roughly 0.0486. The authors find that the probability declines dramatically with age, reaching 0.0145 by age 30.

Assume that, in each year of life, the probability of experiencing a non-fatal motor vehicle accident is equal to
0.062 - 0.000053*(age^2), where age is defined in discrete one-year intervals.

Acquire an account with the Human Mortality Database and the Human Fertility Database. Use the HMDHFDplus package in R to obtain the 2005 single year age-specific death probabilities from the Human Mortality Database. Answer the following questions:

   A. What proportion of Wisconsinites who live to age 16 will live to age 31 without experiencing a motor vehicle accident?
   B. Among those who live to age 25 accident-free, what is the probability of experiencing an accident by age 31?
   C. Among those who survive to age 16, what is the probability of dying without experiencing an accident by age 31?
   D. If the experience of accidents and the probability of dying are process-dependent, is your estimate for C an overestimate or an underestimate of the true probability?
   E. Push your code to GitHub and share the link with someone from class. Answer here the name of the person(s) to whom you shared the link.

2. A cohort of never-married individuals are subject to two forces of decrement assumed to be constant within each interval x to x+n. The following age-specific rates were calculated for this cohort:
- age-specific mortality rates for never-married individuals: $_nM_x^D$
- age-specific first marriage rages: $_nM_x^M$ These are assumed to be zero above the age of 50.

   A. Write an expression in terms of these age-specific transition rates ($_nM_x^D$ and $_nM_x^M$) for the probability of being never married at age 50 for a newborn.
   B. Write an expression in terms of these age-specific transition rates for the probability of being never married at age 50 for a newborn, *net of mortality*.
   C. A second cohort is subject to the same first marriage rates described above but experiences mortality rates that are 20% lower at each age. For this second cohort, write expressions for the probabilities described in (1) and (2). Compare these probabilities with those of the first cohort; which are larger?
   D. You study the population of Sulawesi and observe that the proportion of newborns that are never married at age 50 has stayed constant over time. Yet mortality conditions of individuals have improved at every age during the same period. What can be concluded about trends in first marriage rates in Sulawesi? Why?