SOC 756: Problem Set 3

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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 x (age2), 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:

```
# Used the following code to get the data

# blt <- readHMDweb(
#   CNTRY = "USA",
#   item = "bltper_1x1",
#   username = "frumh002@umn.edu"
# ) |>
#   filter(Year == 2005) |>
#   rename(
#     year = Year,
#     age = Age
#   ) |>
#   select(-OpenInterval) |>
#   mutate(
#     age = as.numeric(age)
#   )

df <- blt |>
  filter(age >= 16, age <= 31) |>
  mutate(
```

```
    nqxi = 0.062 - (0.000053 * (age^2)),
    new_px = 1 - (nqxi + qx),
    new_lx = accumulate(new_px, `*`, .init = 85000)[-1],
    new_lx = lag(new_lx, default = 85000),
    ndxi = nqxi * new_lx,
    npxi = 1 - nqxi,
    dx = qx * new_lx,
    lxi = accumulate(npxi, `*`, .init = 100000)[-1],
    lxi = lag(lxi, default = 100000)
  )
```

a) What proportion of Wisconsinites who live to age 16 will live to age 31 without experiencing a motor vehicle accident?

Of those who survived to age 16, 59.6% will live to age 31 without experiencing a motor vehicle accident.

```
# The new_lx calculates the number of people who are still alive
# and haven't yet experienced a motor vehicle accident
df$new_lx[df$age == 31] / df$new_lx[df$age == 16]
```

```
[1] 0.5956642
```

b) Among those who live to age 25 accident-free, what is the probability of experiencing an accident by age 31?

Of those who lived to age 25 accident-free, 12.4% will experience a motor vehicle accident by age 31.

```
# The lxi calculates the number of people who have not experienced
# motor vehicle accident yet
# The new_lx calculates the number of people who are still alive
# and haven't yet experienced a motor vehicle accident
1 - (df$lxi[df$age == 31] / df$lxi[df$age == 25])
```

```
[1] 0.1237508
```

c) Among those who survive to age 16, what is the probability of dying without experiencing an accident by age 31?

Of those who survived to age 16, 1.02% will die by age 31 without experiencing a motor vehicle accident.

```
num <- df |>
  filter(age != 31) |>
  summarise(sum = sum(dx)) |>
  pull()

num / 85000
```

[1] 0.01022214

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?

The probability of folks in accidents is inversely correlated with overall death rate. Given a certain death rate from any cause, the proportion of folks in accidents will be lower the higher the death rate from other causes.

e) Extra Credit: 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.

The github link for this class and assignment can be found here.

I shared this with Alyssa Mugavero.