Soc 756
Problem Set 4

Increment Decrement Life Tables

Table 1 (on the class web page) includes the age-specific probabilities of starting smoking, quitting smoking, dying while being a smoker, and dying while being a nonsmoker for Italian men born in the 1950's.[a] Note that "starting smoking" does **not** necessarily mean starting smoking for the first time.

Roughly 1,740,000 Italian boys born in 1955 survived to age 10. Assume that 98% of these boys were non-smokers at age 10, 2% were smokers at age 10, and all of the smokers at age 10 had been smoking continuously since they began smoking. Use the probabilities in Table 1 to calculate the ${}_{}l_x^i$, ${}_1d_x^{ij}$, ${}_1L_x^{ij}$ columns of an increment decrement life table for these boys from age 10 to age 50. Note that you do **not** need matrix algebra or particularly complicated equations to do this. Then, use the table from Schoen 1988: p95 (handed out in class) to answer the following questions.

1. What was the probability that a boy alive at age 10 would have ever smoked by age 50?

2. How many years above age ten could a boy surviving to age 10

    a. expect to be a smoker?
    b. expect to be a non-smoker?
    c. expect to live?

3. Conditioning on persons under age 50 as you are doing, is the average age of smokers or non-smokers **younger**?

4. Graph the age-specific probabilities of transitioning into smoking and out of smoking on the same figure. Is the graph consistent with your answer to question 3? Why or why not?

5. Could you calculate the average duration of quitting spells (periods of time when those who once smoked were not smoking) using the life table you have created? Why or why not?

6. Related: the increment-decrement life table assumes a homogenous application of transition probabilities to all persons in a given state at a given age. Why might this assumption be problematic when studying smoking - particularly when using the three-state system defined here? If you had better data, how might you improve your ability to model the smoking experiences of this cohort?

    (If helpful, note that the true cumulative conditional probability of ever smoking for Italian males born in 1955 was 0.53, per Federico et al. 2007 *AJPH*).

7. Generate two additional lifetables that condition on smoking status at age 10. Generate a figure that summarizes the expected duration in each state (smoking and non-smoking) by the smoking status of the children at age 10.

Italian Men, born 1950-1959 [a]

Age	Probability of starting smoking	Probability of quitting smoking	Probability of dying if non-smoker	Probability of dying if a smoker
10	0.018	0.006	0.00036348	0.00036348
11	0.018	0.006	0.00035077	0.00035077
12	0.018	0.006	0.00038324	0.00038324
13	0.018	0.006	0.00045705	0.00045705
14	0.018	0.006	0.00056696	0.00056696
15	0.078	0.006	0.00069567	0.00069567
16	0.078	0.006	0.00086508	0.00086508
17	0.078	0.006	0.00102445	0.00102445
18	0.078	0.006	0.00109701	0.00109701
19	0.078	0.006	0.00110246	0.00110246
20	0.04	0.01	0.000752794	0.00215084
21	0.04	0.01	0.00074298	0.0021228
22	0.04	0.01	0.000763238	0.00218068
23	0.04	0.01	0.000779933	0.00222838
24	0.04	0.01	0.000774312	0.00221232
25	0.0102	0.0128	0.000743092	0.00212312
26	0.0102	0.0128	0.00069489	0.0019854
27	0.0102	0.0128	0.00066157	0.0018902
28	0.0102	0.0128	0.000673008	0.00192288
29	0.0102	0.0128	0.00071001	0.0020286
30	0.012	0.02	0.000778337	0.00333573
31	0.012	0.02	0.000843234	0.00361386
32	0.012	0.02	0.000912198	0.00390942
33	0.012	0.02	0.000957894	0.00410526
34	0.012	0.02	0.001017562	0.00436098
35	0.0108	0.0196	0.001063223	0.00455667
36	0.0108	0.0196	0.001116885	0.00478665
37	0.0108	0.0196	0.001204854	0.00516366
38	0.0108	0.0196	0.001342397	0.00575313
39	0.0108	0.0196	0.001515549	0.00649521
40	0.01	0.022	0.001700384	0.00728736
41	0.01	0.022	0.001919204	0.00822516
42	0.01	0.022	0.002191042	0.00939018
43	0.01	0.022	0.002394728	0.01026312
44	0.01	0.022	0.002652783	0.01136907
45	0.01	0.0198	0.002990225	0.01281525
46	0.01	0.0198	0.003315557	0.01420953
47	0.01	0.0198	0.003696819	0.01584351
48	0.01	0.0198	0.004169879	0.01787091
49	0.01	0.0198	0.004615513	0.01978077
50				

[a]Note: Data not accurate but instead approximated from Federico et al. 2007 *AJPH*, Woloshin et al. 2008 *J Natl Cancer Inst*, Cohen and Lichtenstein 1990 *Health Psychology* and the Italian period life table for males from 1975.