Assignment 11.2

Exercises 13 - 1

http://thinkstats2.com

In [1]:

```
# Imports
import numpy as np
import pandas as pd
import statsmodels.formula.api as smf

import nsfg
import thinkstats2
import thinkplot
import survival
```

In [2]:

```
from IPython.core.display import HTML
table_css = 'table {align:left;display:block} '
HTML('<style>{}</style>'.format(table_css))
```

Out[2]:

Exercise 13-1

In NSFG Cycles 6 and 7, the variable cmdivorcx contains the date of divorce for the respondent’s marriage, if applicable, encoded in century-months.

Compute the duration of marriages that have ended in divorce, and the duration, so far, of marria are ongoing. Estimate the hazard and survival curve for the duration of marriage.

Use resampling to take into account sampling weights, and plot data from several resamples to v sampling error.

Consider dividing the respondents into groups by decade of birth, and possibly by age at first ma

In [3]:

```
# data
resp6 = survival.ReadFemResp2002()
print(f"Resp 2002: {resp6.head()}")

resp7 = survival.ReadFemResp2010()
print(f"\nResp 2010: {resp7.head()}")
```

```
Resp 2002:    caseid  cmbirth  evrmarry  cmmarrhx  cmdivorcx  parity     fina
\
0    2298      902     False        NaN        NaN       4  5556.717241
1    5012      718      True      974.0     1077.0       1  4744.191350
2   11586      708      True      910.0      938.0       1  4744.191350
3    6794     1042     False        NaN        NaN       0  5923.977368
4     616      991     False        NaN        NaN       0  7229.128072

   cmintvw   agemarry        age  year  decade  fives
0     1234        NaN  27.666667    75       7     15
1     1233  21.333333  42.916667    59       5     11
2     1234  16.833333  43.833333    58       5     11
3     1234        NaN  16.000000    86       8     17
4     1233        NaN  20.166667    82       8     16

Resp 2010:    caseid  cmbirth  evrmarry  cmmarrhx  cmdivorcx  parity      wgt
\
0   34156      799     False        NaN        NaN       0   2571.376599
1   40081      925      True     1314.0        NaN       0  11716.317848
2   32817      958     False        NaN        NaN       0   6794.156444
3   39968      869     False        NaN        NaN       0   5469.435481
4   27121     1004     False        NaN        NaN       0   6544.538107

   cmintvw      finalwgt   agemarry        age  year  decade  fives
0     1323   2571.376599        NaN  43.666667    66       6     13
1     1323  11716.317848  32.416667  33.166667    77       7     15
2     1287   6794.156444        NaN  27.416667    79       7     15
3     1323   5469.435481        NaN  37.833333    72       7     14
4     1285   6544.538107        NaN  23.416667    83       8     16
```

In [4]:

```python
def CleanData(resp):
    """
    Cleans respondent data.

    args:
        resp: DataFrame
    """
    # replace invalid values with nan
    resp.cmdivorcx.replace([9998, 9999], np.nan, inplace=True)

    # create new variables
    resp["notdivorced"] = resp.cmdivorcx.isnull().astype(int)
    resp["duration"] = (resp.cmdivorcx - resp.cmmarrhx) / 12.0
    resp["durationsofar"] = (resp.cmintvw - resp.cmmarrhx) / 12.0

    # create decade of age
    month0 = pd.to_datetime("1899-12-15")
    dates = [month0 + pd.DateOffset(months=cm) for cm in resp.cmbirth]
    resp["decade"] = (pd.DatetimeIndex(dates).year - 1900) // 10
```

In [5]:

```python
CleanData(resp6)
married6 = resp6[resp6.evrmarry == 1]

CleanData(resp7)
married7 = resp7[resp7.evrmarry == 1]
```

```
In [6]: def ResampleDivorceCurve(resps):
            """
            Plots divorce curves based on resampled data.

            args:
                resps: list of respondent DataFrames
            """
            for _ in range(11):
                samples = [thinkstats2.ResampleRowsWeighted(resp) for resp in res
                sample = pd.concat(samples, ignore_index=True)

                PlotDivorceCurveByDecade(sample, color="#225EA8", alpha=0.1)

            thinkplot.Show(xlabel="years", axis=[0, 28, 0, 1])
```

```
In [7]: def ResampleDivorceCurveByDecade(resps):
            """
            Plots divorce curves for each birth cohort.

            args:
                resps: list of respondent DataFrames
            """
            for i in range(41):
                samples = [thinkstats2.ResampleRowsWeighted(resp) for resp in res
                sample = pd.concat(samples, ignore_index=True)

                groups = sample.groupby("decade")

                if i == 0:
                    survival.AddLabelsByDecade(groups, alpha=0.7)

                EstimateSurvivalByDecade(groups, alpha=0.1)

            thinkplot.Config(xlabel="Years", ylabel="Fraction undivorced", axis=[
```

```
In [8]: def EstimateSurvival(resp):
            """
            Estimates the survival curve.

            args:
                resp: DataFrame of respondents

            returns:
                pair of HazardFunction, SurvivalFunction
            """
            complete = resp[resp.notdivorced == 0].duration.dropna()
            ongoing = resp[resp.notdivorced == 1].durationsofar.dropna()

            hf = survival.EstimateHazardFunction(complete, ongoing)
            sf = hf.MakeSurvival()

            return hf, sf
```

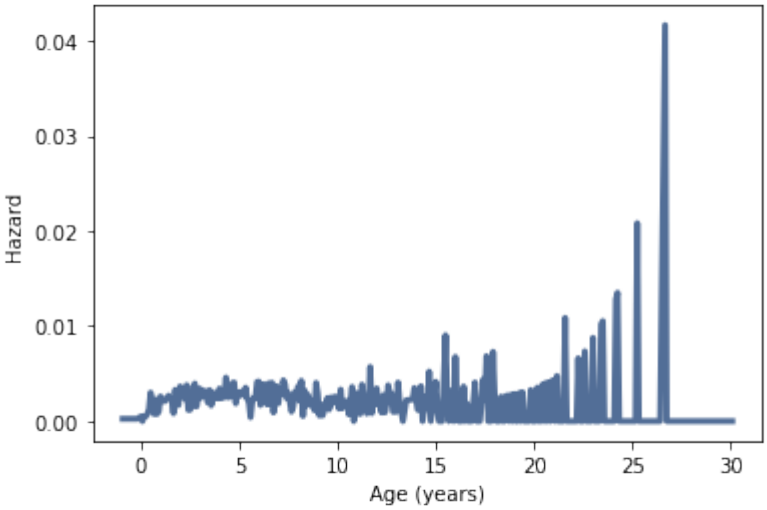
```
In [9]: def EstimateSurvivalByDecade(groups, **options):
            """
            Groups respondents by decade and plots survival curves.

            args:
                groups: GroupBy object
            """
            thinkplot.PrePlot(len(groups))

            for name, group in groups:
                _, sf = EstimateSurvival(group)
                thinkplot.Plot(sf, **options)
```

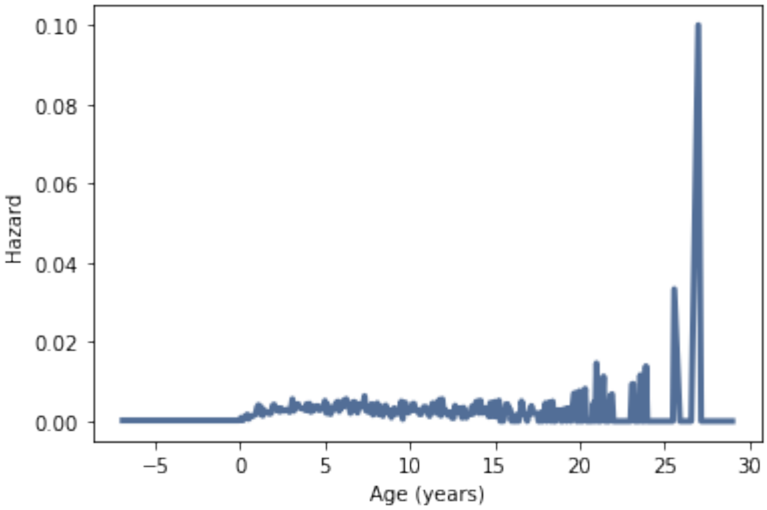
```
In [10]: hf, sf = EstimateSurvival(resp6)

         thinkplot.Plot(hf)
         thinkplot.Config(xlabel='Age (years)', ylabel='Hazard')
```

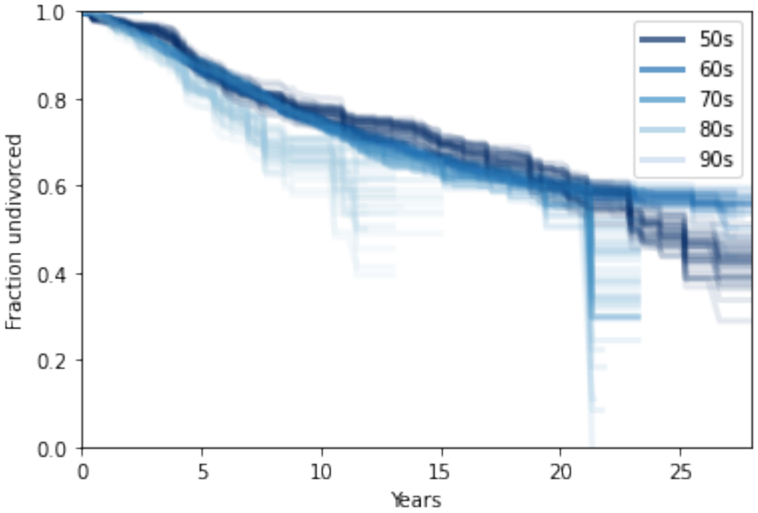


```
In [12]: hf, sf = EstimateSurvival(resp7)

         thinkplot.Plot(hf)
         thinkplot.Config(xlabel='Age (years)', ylabel='Hazard')
```



```
In [11]: ResampleDivorceCurveByDecade([married6, married7])
```


1.0
0.8
0.6
0.4
0.2
0.0
Fraction undivorced
0
5
10
15
20
25
Years
50s
60s
70s
80s
90s

```
In [ ]:
```