The Mathematics of Marriage

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Load in plots package:

```
> restart;
  with(plots) :
```

Here is the data from Table 3.11 for the male 1940-44 cohort, percentage data rescaled to fractions:

```
> men4044 := [[0, 21.1/100], [5, 66.1/100], [10, 83.1/100], [15, 88.8/100], [20, 91.2/100], [25, 92.7/100], [30, 94.0/100]];
  N := nops(men4044)
```

A plot of the data

```
> plt1 := pointplot(men4044, symbol = solidcircle, symbolsize = 20, color = red)
```

The function P(t) that might fit this data, according to the model, is

```
> P0 := men4044[1, 2] : #Fraction of men married at 20.
  P(t) := P0 / (P0 + (1 - P0)·exp(-A·(b^t - 1)/ln(b))) :
  P(t)
```

Form a sum of squares to fit the data

```
> SS := add((P(men4044[j, 1]) - men4044[j, 2])^2, j = 1..N) :
```

Now minimize in A and b. A contour plot of log(SS) may be helpful.

```
> contourplot(ln(SS), A = 0..1, b = 0..1, filled = true, contours = 20, coloring = ["Yellow", "Red"])
```

Something near A = 0.6, b = 0.9 looks promising. We can set dSS/dA = 0 and dSS/db = 0 to find this point.

```
> dSSdA := diff(SS, A) :
  dSSdb := diff(SS, b) :
  Absol := fsolve({dSSdA = 0, dSSdb = 0}, {A, b}, {A = 0.4..0.7, b = 0.8..1})
```

Plot P(t) with these values, compare to the data

```
> plt2 := plot(subs(Absol, P(t)), t = 0..30, color = blue) :
> display(plt1, plt2)
```

Here is the data for the 1945-49 men

```
> men4549 := [[0, 22.3/100], [5, 65.5/100], [10, 80.1/100], [15, 86.1/100], [20, 89.3/100], [25, 91.3/100], [30, 92.5/100]];
```

For the 1940-44 women:

```
> women4044 := [[0, 48.1/100], [5, 78.2/100], [10, 86.8/100], [15, 89.7/100], [20, 91.4/100], [25, 92.5/100],
```

$$\left[30,\ \frac{93.2}{100}\right]\Big];$$

For the 1945-49 women:

> $$women4549 := \left[\left[0,\ \frac{43.1}{100}\right], \left[5,\ \frac{76.9}{100}\right], \left[10,\ \frac{85.0}{100}\right], \left[15,\ \frac{88.4}{100}\right], \left[20,\ \frac{90.2}{100}\right], \left[25,\ \frac{91.5}{100}\right], \left[30,\ \frac{92.2}{100}\right]\right];$$

>