

## Attachment: running fortran program lynems.f

a.out

This program estimates HIV intensities from observed AIDS incidences and an assumed known incubation distribution using the ems algorithm.  
Future AIDS incidences can also be predicted.

On the first run, a new set of AIDS data must be used, a new incubation distribution specified and new starting HIVs set.

```
Describe AIDS data, (<30 char),to end type: stop )
Australia 1979-1993 median 12yrs
Write run output filename, <= 8 char without extension ozout
New AIDS data, Y/N ? y
AIDS filename ? oz.dat
Type in #AIDS data points to be used 52
```

*the data begin in the first quarter of 1981, and we are fitting the model to data to the end of 1993*

```
Type in #initial zeros for AIDS vector for which HIV will be calculated
so that time origin is Jan 1979 : 8
! Number time intervals per year is 12
Change # time intervals per year, Y/N ? y
Number time intervals per year is : 4
```

*we have quarterly data*

5054.00

*this is the total observed AIDS incidence to the end of 1993*

```
! Convergence epsilon is 0.1E-06 , ignoring last 0 estimated HIVs
Change convergence criteria, Y/N ? n
Smoothing is into fixed tail, change this, Y/N ? y
Type of endpoint smoothing: 1 into fixed tail
                             2 indep of tail
Type 1 or 2
```

2

*the fixed tail option is when e.g. infections may have stopped abruptly*

```
n_td (old) conditioning, change this, Y/N ? n
```

*this is the EM iterative routine in Becker et al's (1991) paper*

```
Number of prediction intervals are 0
Change # prediction intervals, Y/N ? y
Type in # prediction intervals wanted : 20
```

*we want to predict AIDS to the end of 1998 (i.e. 5 years = 20 quarters)*

```
Incubation distribution is not set or is from file
New incubation distribution, Y/N ? y
Is the new prob. dist. to be read from file ? n
Assuming Weibull,  $S(t)=\exp-(bt)**c$ , t in yrs, enter b & c
.0720 2.516
b = 0.0720 and c = 2.5160
Correct, Y/N ? y
```

*this is Weibull distribution with median 12 years*

```
Write incubation distribution to file, Y/N ? y
! Cumulative distribution function
0.000 0.000 0.000 0.001
0.001 0.002 0.004 0.005
0.008 0.010 0.013 0.017
0.021 0.026 0.031 0.036
0.043 0.050 0.057 0.065
0.074 0.083 0.093 0.103
0.114 0.126 0.138 0.150
0.163 0.177 0.191 0.206
0.221 0.236 0.252 0.269
0.285 0.302 0.319 0.337
0.354 0.372 0.390 0.408
0.427 0.445 0.463 0.481
0.500 0.518 0.536 0.554
0.571 0.589 0.606 0.623
0.639 0.656 0.672 0.688
```

```
! Probability distribution function
0.000 0.000 0.000 0.001
0.001 0.001 0.002 0.002
0.003 0.003 0.004 0.004
0.005 0.005 0.006 0.006
0.007 0.007 0.008 0.009
0.009 0.010 0.010 0.011
0.012 0.012 0.013 0.013
0.014 0.014 0.015 0.015
0.015 0.016 0.016 0.017
0.017 0.017 0.017 0.018
0.018 0.018 0.018 0.018
0.018 0.018 0.018 0.018
0.018 0.018 0.018 0.018
0.017 0.017 0.017 0.017
0.016 0.016 0.016 0.015
```

**Note:** when reading the incubation probabilities from an external file, the matrices must have the correct dimensions e.g. if we have 18 years of data in annual counts (1981 to 1998 say) and you want HIV incidence to start in 1979 (i.e. 2 prior zeroes), and you also want to project AIDS

*incidence to 2003 (i.e. for the next 5 years), then the progression probability matrices need to be 25 x 25 square. Note that the program lynems.f does not write the probabilities to a file in this form.*

Starting HIV's all 50.00 and the last 24 set at 50.00

Change starting HIV's, Y/N ? y

Type in # fixed lamdas for recent times : 0

HIV from input file, Y/N ? n

Type in starting HIV per time unit (at least 1) 50

! Smoothing by binomial weights, bandwidth is 1

Change, Y/N ? y

Type of smoothing: 1 Binomial

2 Own choice

3 Exponential

4 Uniform

5 Progressive, only for monthly data

Choose 1,2,3 4 or 5

1

Bandwidth? Choose odd 1 to 13 (1 means no smoothing)

3

**3 corresponds to  $k=2$ , a low degree of smoothing**

Number of iterations between interim reports is 100

Change this, Y/N ? n

! Iter	Loglkhd	logdiff	HIVs	epsi	AIDStot
! 0	14879.1182	0.0000	3000.0	0.00E+00	771.1

Number of iterations to try is 200

Change this, Y/N ? n

! 100	20254.9414	0.0000	13572.2	0.51E-06	5054.7
! 123	20255.7695	0.0000	13526.0	0.94E-07	5054.7

! Estimated HIV incidences

8.5	11.4	17.1	26.3
40.4	60.9	89.3	127.3
176.2	236.6	308.5	390.1
478.5	569.2	656.7	735.1
798.6	842.8	864.4	862.4
837.8	793.5	733.9	663.7
587.8	510.2	434.3	362.8
297.4	239.5	189.6	147.7
113.3	85.7	64.0	47.1
34.3	24.7	17.6	12.4
8.7	6.1	4.2	2.9
2.0	1.3	0.9	0.6
0.4	0.3	0.2	0.1
0.1	0.1	0.1	0.0
0.0	0.0	0.0	0.0

Write expected AIDS to file, Y/N ? y

```

! Expected AIDS incidences
    0.0      0.0      0.0      0.0
    0.0      0.1      0.1      0.2
    0.3      0.4      0.6      0.9
    1.4      1.9      2.7      3.6
    4.9      6.4      8.2     10.4
   13.0     15.9     19.3     23.1
   27.2     31.8     36.8     42.1
   47.7     53.6     59.9     66.3
   73.0     79.9     87.0     94.1
  101.4    108.7    116.1    123.5
  130.8    138.1    145.4    152.5
  159.5    166.3    172.9    179.3
  185.5    191.5    197.1    202.5
  207.5    212.2    216.5    220.5
  224.1    227.3    230.1    232.5

```

! Predictions for next 20 time intervals are :

```

!      235.      236.      237.      238.
!      238.      238.      238.      237.
!      235.      234.      231.      229.
!      226.      223.      220.      216.
!      212.      207.      203.      198.
!

```

Total prediction for next 20 time intervals is 4530.

Choose prediction type: 0 stop, 2 Xtn , 3 Hilo

Option 3 is not sensible if window is 1 or last HIVs are fixed.

2

*this assumes HIV incidence continues at the last observed value, here 0*

! Predictions for next 20 time intervals are :

```

!      235.      236.      237.      238.
!      238.      238.      238.      237.
!      235.      234.      231.      229.
!      226.      223.      220.      216.
!      212.      207.      203.      198.
!

```

Total prediction for next 20 time intervals is 4530.

Choose prediction type: 0 stop, 2 Xtn , 3 Hilo

Option 3 is not sensible if window is 1 or last HIVs are fixed.

3

*this assumes HIV incidence continues as constant from: 1/3 between maximum and last value, 2/3 between maximum and last value, and constant from max HIV respectively*

! Predictions for next 20 time intervals are :

```

!      284.      290.      295.      300.
!      305.      309.      313.      317.
!      320.      324.      326.      329.
!      331.      333.      335.      336.
!      337.      338.      339.      339.
!

```

```

Total prediction for next 20 time intervals is      6404.
! Predictions for next    20 time intervals are :

```

```

!      359.      369.      380.      389.
!      399.      408.      418.      427.
!      435.      444.      452.      459.
!      467.      474.      481.      488.
!      494.      500.      506.      511.
!

```

```

Total prediction for next 20 time intervals is      8860.
! Predictions for next    20 time intervals are :

```

```

!      454.      469.      484.      499.
!      514.      529.      543.      557.
!      571.      585.      598.      611.
!      624.      636.      648.      659.
!      671.      682.      692.      702.
!

```

```

Total prediction for next 20 time intervals is      11726.

```

```

Choose prediction type: 0 stop, 2 Xtn , 3 Hilo

```

```

Option 3 is not sensible if window is 1 or last HIVs are fixed.

```

```
0
```

```

Goodness of fit, residuals or simulate, Y/N ? y

```

```

! Goodness of fit = 114.07

```

*this is the sum of the squared standardardized residuals*

```

-0.02 -0.05 -0.08 -0.12
-0.17 -0.24 -0.31 -0.40
-0.51 -0.64  0.47 -0.97
-1.16 -1.39 -1.64 -1.38
-2.21 -2.13 -2.17 -2.30
-3.32 -2.49 -0.75 -0.02
 0.14  1.45 -1.11 -1.86
-0.68 -0.09  0.79  0.57
 1.87  1.91  0.65  1.22
 0.56  0.60  3.15  3.38
 1.94 -0.35  1.21  1.18
 0.76 -1.34  0.84 -0.55
 1.06  0.26  0.42  0.11
-1.35 -0.49 -0.92 -1.99
-1.28 -2.48  0.26 -1.15

```

Write output datafile, Y/N ? y

8 52 20

Describe AIDS data, (<30 char),to end type: stop )

**and now start again choosing different options!**