Question One

In this question we are asked to focus on 18 year olds. The required data is given below:

Individual	a_i	b_i	υ_i	δ_i
1	–	–	–	–
2	0	1	.2	1
3	0	1	1	0
4	.1	1	.1	1
5	0	1	1	0
6	–	–	–	–
7	.1	1	.9	0
8	0	1	1	0
9	0	1	1	0
10	.1	.8	.6	1

$d = 3, \ \upsilon = 5.8$

$$\hat{\lambda} = \frac{3}{5.8} = .517$$

$$SE\left(\hat{\lambda}\right) = \sqrt{\frac{3}{(5.8)^2}} = .299$$

Question Two

The data for the second year post operation is

Patient	*a*	*b*	*T*	*v*	δ
1	0	1	1	1	0
2	0	.6	.2	.2	1
3	0	1	1	1	0
4	0	0.2	0.1	.1	1
7	.4	1	.8	.4	1
8	0	1	1	1	0
9	0	.5	.5	.5	0
11	0	.1	.1	.1	0
12	.9	1	1	.1	0
13	.5	1	.8	.3	1
14	.6	1	1	.4	0

$$\hat{\lambda}_1 = \frac{d}{v} = \frac{4}{5.1} = 0.7843$$

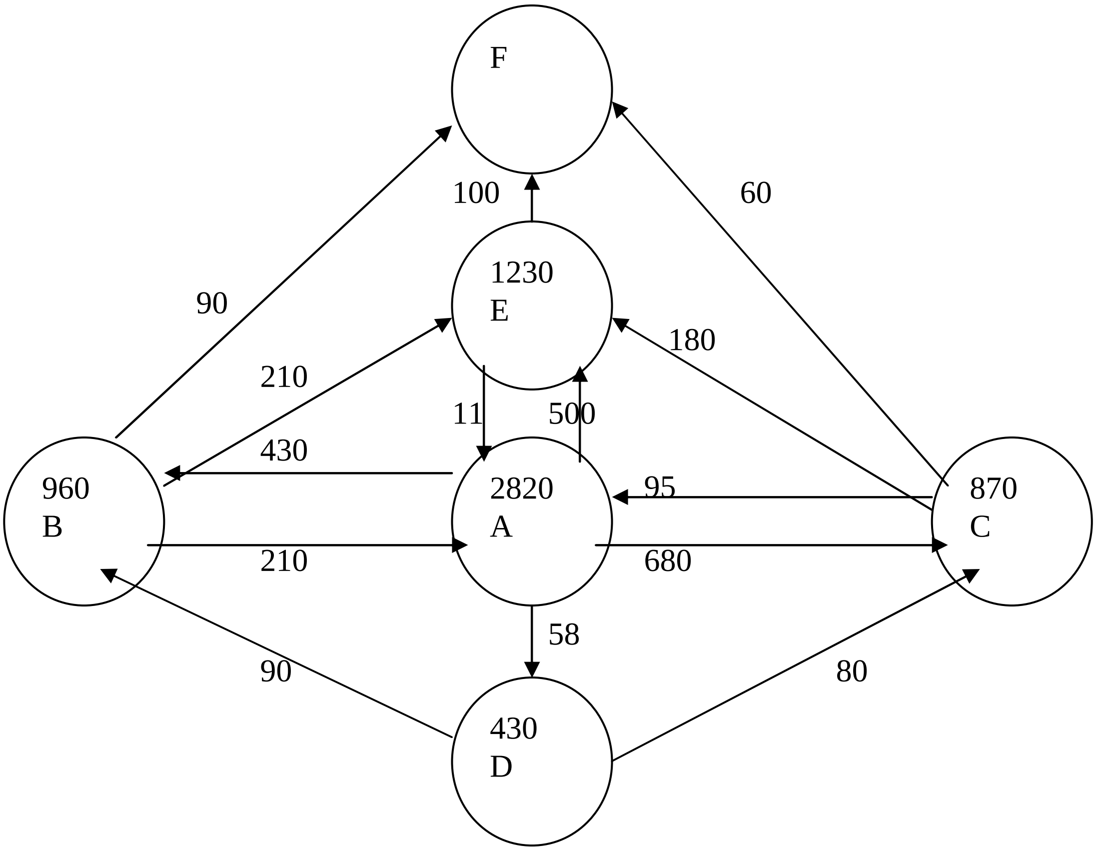
The standard error is

$$\frac{\sqrt{d}}{v} = \frac{\sqrt{4}}{5.1} = 0.392$$

The probability of interest is $p_1 = e^{-\lambda_1}$ which can estimate by $\hat{p}_1 = e^{-0.5\times 0.7843}$.

Question Three

(a) The multi-state model is depicted below



The estimated transition intensities are provided below:

	A	B	C	D	E	F
A	0	430/2820	680/2820	58/2820	11/2820	0
B	210/960	0	0	0	210/960	90/960
C	95/870	0	0	0	180/870	60/870
D	0	90/430	80/430	0	0	0
E	500/1230	0	0	0	0	100/1230
F	0	0	0	0	0	0

The confidence intervals are given below:

CA: $\frac{95}{870} \pm 1.65 \frac{\sqrt{95}}{870}$

CE: $\frac{180}{870} \pm 1.65 \frac{\sqrt{180}}{870}$

CF: $\dfrac{60}{870} \pm 1.65\dfrac{\sqrt{60}}{870}$

(b) The probability is $1-\exp(-1.5(\hat{\lambda}_{AB}+\hat{\lambda}_{AC}+\hat{\lambda}_{AD}+\hat{\lambda}_{AE}))$

(c) The estimated mean is $(\hat{\lambda}_{AB}+\hat{\lambda}_{AC}+\hat{\lambda}_{AD}+\hat{\lambda}_{AE})^{-1}=2.392$.