HW4

A

Exponential with $\lambda = 5$ implies that mean is $\frac{1}{5}$.

If $1 - U \sim Unif(0, 1)$, then $-logU \sim Exp(1)$.

We want $Exp(5)$ with mean $\frac{1}{5}$, thefore we will work with $-\frac{1}{5}logU$

I am using a `while` loop to produce observation of 'inter arrival' times until they reach a total of 12. Results are presented below:

```
Total individuals infected (N(12)): 66
```

Index	Uniform Number	Exponential Number	S_i
1	0.8444064	0.0338243	0.0338243
2	0.5501890	0.1194987	0.1533230
3	0.2572783	0.2715194	0.4248424
4	0.8692148	0.0280330	0.4528754
5	0.8717278	0.0274556	0.4803310
6	0.4227091	0.1722142	0.6525452
7	0.9250984	0.0155710	0.6681162
8	0.6685346	0.0805334	0.7486496
9	0.1392716	0.3942659	1.1429155
10	0.5488394	0.1199899	1.2629054

B

Using $Exp(2)$ we model additional ime to infection. I modify the data frame I presented earlier. First 10 observations of time to infection and

Index	Uniform Number	Exponential Number	S_i	Uniform Number for Y_i	Y_i
1	0.8444064	0.0338243	0.0338243	0.7322608	0.1558092
2	0.5501890	0.1194987	0.1533230	0.3262280	0.5600793
3	0.2572783	0.2715194	0.4248424	0.8185922	0.1000846
4	0.8692148	0.0280330	0.4528754	0.2510494	0.6910528
5	0.8717278	0.0274556	0.4803310	0.8426709	0.0855894
6	0.4227091	0.1722142	0.6525452	0.1655747	0.8991664
7	0.9250984	0.0155710	0.6681162	0.7070882	0.1732999
8	0.6685346	0.0805334	0.7486496	0.7710383	0.1300086
9	0.1392716	0.3942659	1.1429155	0.2822159	0.6325415
10	0.5488394	0.1199899	1.2629054	0.2978221	0.6056294

C

Further, we apply desired data wrangling to the data set from part B. 10 observations from the data set after modifications are below. $N.$ is the t for $N(t)$ process, while $N.1$ is the t for $N_1(t)$ process. For people indexed 4 and 6, symptoms occur at time period 2, while infection sets in time period 1:

Index	Uniform Number	Exponential Number	S_i	Uniform Number for Y_i	Y_i	S_i + Y_i	N(t)	N_1 (t)
1	0.8444	0.0338	0.0338	0.7323	0.1558	0.1896	1	1
3	0.2573	0.2715	0.4248	0.8186	0.1001	0.5249	1	1
5	0.8717	0.0275	0.4803	0.8427	0.0856	0.5659	1	1
2	0.5502	0.1195	0.1533	0.3262	0.5601	0.7134	1	1
7	0.9251	0.0156	0.6681	0.7071	0.1733	0.8414	1	1
8	0.6685	0.0805	0.7486	0.7710	0.1300	0.8787	1	1
4	0.8692	0.0280	0.4529	0.2510	0.6911	1.1439	1	2
6	0.4227	0.1722	0.6525	0.1656	0.8992	1.5517	1	2
9	0.1393	0.3943	1.1429	0.2822	0.6325	1.7755	2	2
10	0.5488	0.1200	1.2629	0.2978	0.6056	1.8685	2	2

D

One final replication of the counting process is given below. At every time point the number of infected people with symptoms is less than or equal to the number of people with an infection.