Appendix 3

A 3.1 Generation of Zero Inflated Poisson observations

The probability mass function of Zero Inflated Poisson Distribution is given by,

$$P(X = x) = \begin{cases} 1 - \pi + \pi\, e^{-\theta}, & \text{for } X = 0 \\ \dfrac{\pi\, e^{-\theta} \theta^{x}}{x\,!}, & \text{for } X = 1,2,3,\ldots\ \theta > 0.\ \ 0 < \pi < 1. \end{cases}$$

Suppose n observations to be generated. Repeat the following two steps n times.

Step-1. Generate $U(0,1)$ observation

Step-2. If $U < \pi$ then generate observation from Poisson (λ), otherwise $X = 0$.

To generate observation from Poisson (λ) we use following algorithm.

1. Initialize Product=1.0
2. Generate $U(0,1)$ say U
3. Product = Product * U
4. If Product $< e^{-\lambda}$ then X = number of uniforms-1, otherwise go to step-2.

A 3.2 Generation of Zero Inflated Negative Binomial observations

The probability mass function of Zero Inflated Negative Binomial Distribution is given by,

$$P(X=i)=\begin{cases}(1-\pi)+\pi\, Q^{-r}\,, & \text{for } i=0\\ \pi\binom{-r}{i}Q^{-r}\left(\frac{-P}{Q}\right)^{i}, & \text{for } i=1,2,3,\ldots\end{cases}$$

$$0<\pi<1$$

where, $p=\frac{1}{Q}, q=\frac{P}{Q}, Q=P+1\;, Q-P=1.$

Suppose n observations to be generated. Repeat the following two steps n times.

Step-1. Generate $U(0,1)$ observation

Step-2. If $U<\pi$ then generate observation from Negative Binomial (r,P),

otherwise $X=0$.

To generate observation from Negative Binomial (r,P).

1 Initialize $Y=0$

2 Generate $U(0,1)$ say $U_i\,(r,P)$

3 Let, $X_i=Int\left[\frac{\log(U_i)}{\log_e(1-P)}\right]$.

4. $Y=Y+\sum_{i=1}^{r}X_i$.

5. Repeat step 2 to step 4 'r' times

A 3.3 Generation of Zero Inflated Binomial observations

The probability mass function of Zero Inflated Binomial Distribution (ZIBD) is given by,

$$P(X=i)=\begin{cases}(1-\pi)+\pi\,(1-\theta)^{n}\,, & \text{for } i=0\\ \pi\binom{n}{i}\theta^{i}(1-\theta)^{n-i}\,, & i=1,2,3,\ldots n. \quad 0<\pi<1, \quad 0<\theta<1.\end{cases}$$

Suppose n observations to be generated. Repeat the following two steps n times.

Step-1. Generate $U(0,1)$ observation

Step-2. If $U<\pi$ then generate observation from Binomial (n,θ) otherwise $X=0$.

To generate observation from Binomial (n,θ))

1 Initialize $Y=0$.

2 Generate $U(0,1)$ say U_i

$$X_i=\begin{cases}1, & \text{if } U_i<\theta\\ 0, & \text{if } U_i>\theta\end{cases}$$

3. $Y=Y+X_i$

4. Repeat step 2 to step 3, 'n' times.