Drill 8

1. Birnbaum and Saunders (1969) proposed the following distribution. Given shape parameter $\alpha > 0$ and scale parameter $\beta > 0$, the probability density function (pdf) and the cumulative distribution function (cdf) are given by

$$f(t) = \frac{1}{2\alpha\beta\sqrt{2\pi}}\left[\sqrt{\frac{\beta}{t}} + \left(\frac{\beta}{t}\right)^{3/2}\right] \exp\left[-\frac{1}{2\alpha^2}\left(\frac{t}{\beta} - 2 + \frac{\beta}{t}\right)\right]$$

and

$$F(t) = \Phi\left[\frac{1}{\alpha}\left(\sqrt{\frac{t}{\beta}} - \sqrt{\frac{\beta}{t}}\right)\right], \quad t > 0,$$

respectively, where $\Phi(\cdot)$ is the standard normal cdf.

   (a) Analogous to the Weibull plot, make a formula for plotting the data from the Birnbaum and Saunders (BS) distribution which draws a straight line.

   (b) Make the plots (Weibull plot and BS plot) using the given data sets in `Data.r` file.

2. Make a R function for Table 2 of Looney and Gulledge, Jr. (1985). The output would be as below:

```
> set.seed(1)
> EPP(n=3, levels=c(0.005, 0.010) )
  0.5%     1%
0.8675 0.8685


> EPP(n=3, levels=c(0, 0.005, 0.010) )
    0%   0.5%     1%
0.8661 0.8675 0.8687
```

3. Make the above R function without using `for( )` loop in R.

References

Birnbaum, Z. W. and Saunders, S. C. (1969). A new family of life distributions. *Journal of Applied Probability*, 6:319–327.

Looney, S. W. and Gulledge, Jr., T. R. (1985). Use of the correlation coefficient with normal probability plots. *The American Statistician*, 39:75–79.