Assignment – Module 3

1. A data set is assumed to follow exponential distribution, with

   $$f(x) = \frac{1}{\alpha} e^{-x/\alpha} \qquad x > 0$$

   In the data set, 60% of the values are less than 2.5, estimate the parameter α.

2. Obtain the maximum likelihood estimators of the parameters a and b for the pdf.

   $$f(x) = \frac{e^{-\left(\frac{x-a}{b}\right)}}{b} \qquad a < x < \infty \text{ , } -\infty < a < \infty \text{ , } b > 0$$

3. Obtain the parameters of the following distribution using method of moments

   $f(x) = (a+1)\, x^{a} \qquad 0 < x < 1$

4. Peak flows at a site have a mean of 675 units and a standard deviation of 220 units. Obtain the maximum probability that the peak flow in a year will deviate more than 450 units from the mean using Chebyshev's inequality.

5. Obtain the correlation coefficient for the yearly rainfall and the yearly runoff of a catchment, 20 years data for which is given below.

Rainfall (cm)	377	363	458	365	430	365	366	317	311	392
Runoff (cm)	365	357	416	358	399	358	359	328	324	375

Rainfall (cm)	353	439	410	423	436	601	336	464	490	402
Runoff (cm)	351	404	386	394	402	506	340	420	436	381

6. Consider the data in the previous problem; obtain the regression equation between rainfall and runoff.

7. Observations for the past 10 years of groundwater discharge and estimated recharge (in consistent units) of an artesian aquifer are given below

Discharge	12.2	10.4	10.6	12.6	14.2	13.0	14.0	12.0	10.4	11.4
Recharge	12.0	9.8	11.0	13.2	14.6	14.0	14.0	12.4	10.4	11.6

   Assuming a linear relationship between discharge and recharge, with discharge as the dependent variable and recharge as independent variable, what will be the discharge when the recharge is 13 units?

8. Generate 50 observations from an exponential distribution with $\lambda = 0.7$, Compare the simulated mean with observed mean.
9. Generate independent samples of 10, 20, 50 and 100 observations from normal distribution with mean 5 and standard deviation 2. Compare these values of mean and standard deviation with the computed ones.
10. Generate independent samples of 10, 20, 30, 40, 50 and100 observations from gamma distribution with $\eta = 2$ and $\lambda = 2$.
11. Assuming that the peak flows (in cumecs) given below follow a (a) Normal Distribution, (b) log-normal distribution, and (c) Exponential Distribution, generate 50 values of the peak flows, and compare the appropriate statistics of the generated flows for each of the distributions used with those of the observed flows

14,000	17,700	17,500	15,500	20,500	18,100	15,800	14,900
16,300	14,900	17,600	17,000	17,300	18,300	19,100	17,900
19,400	22,900	16,200	14,300				