Homework set #2
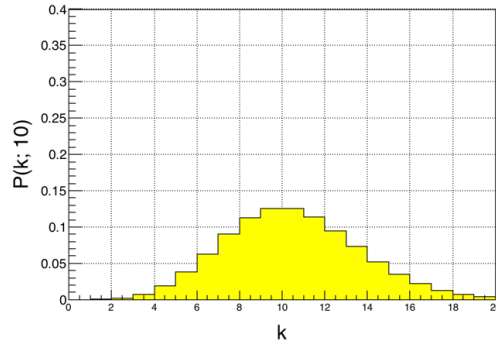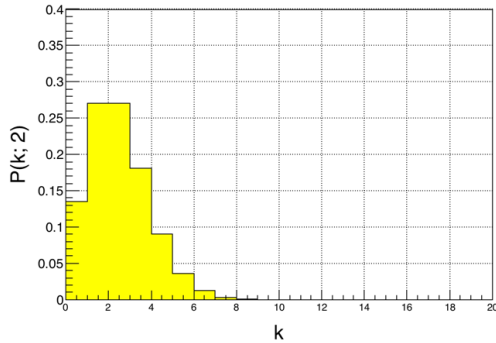
1. Produce below plots for the Poisson distribution using the ROOT framework [Use the exponential function in ROOT → TMath::Exp()]

2. Make a program to produce a histogram (TH1D) by picking up random numbers [0, 10] in the probability density function (TF1) of the Gaussian distribution with m=5 and s=1 in the ROOT framework. Then compare the histogram with the probability function for the Gaussian distribution. (Total number of events, n=10000)

3. Create a program to draw overlap plot for below distributions on same canvas using the ROOT framework.
   a) Binominal distribution (n=50, p=0.5)
   b) Poisson distribution (l=25)
   c) Gaussian distribution (m=25, s=5)
   Compare three distributions with respect to the mean and variance values and explain the results. (If there will no explanation, the score will be zero.)

4. Prove the expectation and the variance of the probability function of the Poisson distribution.

$$E[k] = \sum_{k=0}^{\infty} k \frac{\lambda^k}{k!} e^{-\lambda} = \lambda, \qquad V[k] = \sum_{k=0}^{\infty} (k - \lambda)^2 \frac{\lambda^k}{k!} e^{-\lambda} = \lambda$$

5. Prove the expectation and the variance of the probability function of the Gaussian distribution.

$$E[x] = \mu, \qquad V[k] = \sigma^2$$

This assignment must be submitted to the LMS in a complete report format including source codes and your comments on them. The report has to include the explanation of each problem and result plots. Source codes files are additionally required to be uploaded in the LMS in order to verify your solution.