Statistical Methods

Problem Sheet 3

1. **Histogram making as Bernoulli trials:**
   (a) Generate a sample of uniform random numbers, say `Nsample = 100`.
   (b) Divide the range $[0, 1.0]$ in `Nbin = 50` bins and look at the count in the third bin `n3`, i.e. the count for $x \in [3dx, 4dx]$. Here $dx = 1.0/$`Nb`.
   (c) Repeat the above process `Ntrials = 100` times and add each value of `n3` to a histogram. Comment on the shape of the hisogram.
2. **Poisson and Gaussian distribution:** Run the above code for `Nbin=25` and `Nbin = 5`. Comment on the shapes of the distributions of `n3` you get in these two examples.
3. **Acceptance/rejection method to estimate value of π:**
   (a) Generate two uniform random numbers r_1 and r_2 between 0.0 and 1.0
   (b) Accept the 2-dimensional point (r_1, r_2), i.e. count it, if $\sqrt{r_1^2 + r_2^2} \leq 1$.
   (c) Repeate above step for N_t number of trials.
   (d) The acceptance rate, $A = count/N_t$ is an estimator of $\pi/4$. Plot the error $abs(A - \pi/4)$ as a function of N_t and comment on its shape. (Does is look like $const/\sqrt{N_t}$?)
4. **Maximum Likelihood Estimation:**
   (a) Download the codes `fixexp.C` and `fixexppretty.C` from the website `http://www.iiserkol.ac.in/ ritesh.singh/serc2015.html`
   (b) Follow the instructions in the Tutorial session.