Estimations

1. Use the fact that the series for e^{-1} is an alternating series to estimate it upto second place of decimal. Use this to estimate the probability of at least three successes in a Poisson distribution with $c = 1$. Compare your values to the actual values.

2. Find the point where the graph of $e^{-x^2/2}$ starts curving upward (putting using second derivative as 0). Estimate the area under this curve upto that point using a "house" shape approximation. Use this to estimate the *odds* that the point lies outside "one-sigma". (By "odds" one means the ratio of probability of success to the probability of failure.) Compare your values to the actual values.

3. My mother calls me 4(=4k) times a week on average and my father calls me 2(=2k) times a week on average. If I compare the expected amount of time that I have to wait for 2(=2r) calls from my mother to the amount of time I have to wait for one call($= r$) from my father, which is greater? Suppose I compare the probability of waiting for one week in each case, which is greater? Compare these for other values of k and r.

4. One person does an experiment to measure the mass of an electron and gets the values (in suitable units) 10001, 10001, 10000, 9999, 9999. Another person does the experiment and gets every value 10000+k for k in range $[-2, 2]$ exactly once. For which experimenter is the confidence greater that the result is 10000 ± 0.5.

5. Estimate (or compute) the probability of getting exactly r Heads in k coin flips for the following values of (k, r). Justify your answers.
   (a) $(10, 5)$, $(20, 5)$, $(30, 5)$, $(40, 5)$. What is the trend as k goes to infinity?
   (b) $(10, 3)$, $(20, 6)$, $(30, 9)$, $(40, 12)$. What is the trend as k goes to infinity?
   (c) $(10, 2)$, $(40, 4)$, $(90, 6)$, $(160, 8)$. What is the trend as k goes to infinity?
   (d) $(10, 2)$, $(20, 12)$, $(30, 22)$, $(40, 32)$. What is the trend as k goes to infinity?
   (e) Does your answer in the above questions change if probability of Head is 0.4 instead of 1/2?