**Qn 1**

We already see from the lecture that the larger the sample, the more and more likely that the sampled mean is close to the true mean. The following exercise teaches you that when the minimum and the maximum is known, a more accurate statement can be reached.

Suppose a sample of 100 individuals in a large population is taken and the sample mean age is 40 years. Assume the age in the population is i.i.d. (it may not be normal, can you speculate what it is?) and the minimum age is 0 years and the maximum age is 120 years. What is the probability that the true mean lies between 30 to 50 years?

Use the Hoeffding’s inequality.

(Hoeffding’s Inequality) Let be a sequence of i.i.d. random variables and assume that for all and . Then, for any ,

0.501295583.

**Qn 2**

From the central limit theorem, we know that a binomial distribution can be approximated by a normal distribution when is large. Plot the binomial distribution and the corresponding (approximate) normal distribution. (Choose a by yourself. Write down the corresponding mean and variance of the normal distribution also.)

**Qn 4**

An electric scale gives a reading equal to the true weight plus a random error that is normally distributed with mean 0 and standard deviation mg. Suppose that the results of five successive weightings of the same object in mg are as follows:

3.142, 3.163, 3.155, 3.150, 3.141

1. Determine a 95% confidence interval estimate of the true weight
2. Determine a 99% confidence interval estimate of the true weight

**Qn 5**

The PCB concentration of a fish was measured by a technique that is known to result in an error of measurement that is normally distributed with a standard deviation of 0.08 ppm (parts per million). Suppose the results of 10 independent measurements of this fish are

11.2, 12.4, 10.8, 11.6, 12.5, 10.1, 11.0, 12.2, 12.4, 10.6

Give a 95% confidence interval for the PCB level of this fish