R Practical sheet on Normal distribution

R has four inbuilt functions to generate normal distribution, described as below;

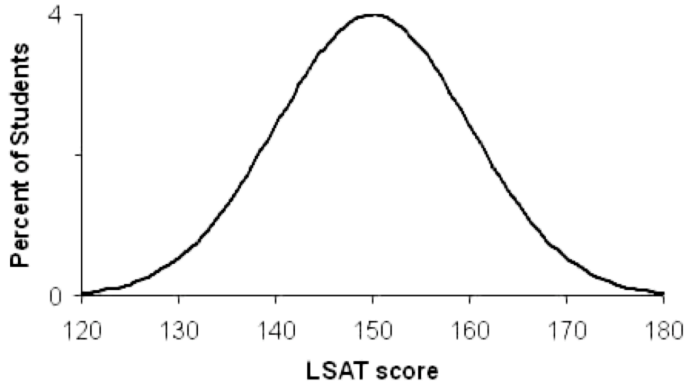
- **dnorm (x, mean, sd)**
- **norm (x, mean, sd)**
- **qnorm(p, mean, sd)**
- **norm (n, mean, sd)**

Use appropriate functions to solve these example.

1. Assume that scores on a Dental anxiety scale (ranging from 0 to 20) are normal for the general population, with mean $\mu = 11$ and standard deviation $\sigma = 3.5$.

(a) What is the probability that a person chosen at random will score between 10 and 15 on this scale?
(b) What is the probability that a person chosen at random will have a score less than 5 on this scale?

2. Let X denote scores on the LSAT for a particular year. The mean of X $\mu = 150$ and the standard deviation is $\sigma = 10$. The histogram for the scores looks like:



What percentage of students had a score of 165 or higher on this LSAT exam?

4. An aeroplane has 200 seats. Knowing that passengers show up to flights with probability only 0.96, the airlines sells 205 seats for each flight. What is the probability that a given flight will be oversold?

5. Melinda McNulty is running for the city council this May, with one opponent, Mark Reckless. She needs to get more than 50% of the votes to win. I take a random sample of 100 people and ask them if they will vote for Melinda or not. Now assuming the population is large, the variable X = number of people who say "yes" has a distribution which is basically a binomial distribution with n = 100. Suppose that in our poll, we found that 40% of the sample say that they will vote for

Melinda. This is not good news, as it suggests $p \approx .4$, but this may be just due to variation in sample statistics.

(a) Use normal approximation to the binomial to see how hopeless the situation is, by asking the question: suppose in reality 50% of the population will vote for Melinda. How likely is it that in a sample of 100 people, we find 40 or fewer people who support Melinda?

(b) In a large population, some unknown proportion p of the people hold opinion o. A pollster, wanting to estimate p, polls 1000 people chosen at random, and asks each if they hold opinion o. She lets X be the number that say "yes".If the pollster uses the proportion X/1000 as an estimate for p, how likely is it that she gets an answer that within ±3.1% of the truth?

(c) What is the conclusion of this exercise?

5. Suppose the width of a turtle's shell follows a uniform distribution with a minimum width of 2 inches and a maximum width of 6 inches. That is, if we randomly selected a turtle and measured the width of its shell, it's equally likely to be *any* width between 2 and 6 inches.

(a) Create a dataset in R that contains the measurements of shell widths for 1,000 turtles, uniformally distributed between 2 and 6 inches. Visualise turtle shell widths with a histogram. Does it look like a normal curve?

(b) Now take repeated random samples of 5 turtles from this population and measure the sample mean over and over again. Perform this process in R and create a histogram to visualize the distribution of sample means. Calculate the sample mean and sample standard deviation for this sampling distribution.

(c) Now increase the sample size that we use from n=5 to n=30 and recreate the histogram of sample means and observe the sample mean and sample standard deviation for this sampling distribution.

(d) Give your interpretations.