1. Systolic blood pressure (usually measured in millimetre mercury or mmHg) measures the blood pressure of the arteries when your heart contracts. A healthy adult typically has a systolic pressure of less than 120 mmHg.
   John is getting old and wanted to see if his systolic pressure was abnormal or too high. Here are the systolic blood pressures recorded at the self-use blood pressure machine at Shoppers Drug Mart.

123	127	121	119	125	135	122

   For your convenience, the summary statistics are $\bar{X} = 123$ and $s = 2.65$.
   Assuming that the above sample is a good representation of John's systolic blood pressure in general, answer the questions below.
   Subjects: measurements or blood pressure tests
   Variable: systolic blood pressure or simply blood pressure
   Type: numerical variable

   a) Identify the parameter of interest. **[2 marks]**

      Define mu as the average systolic blood pressure (mmHg) of all blood pressure tests of John's.

   b) Set up the null hypothesis and the alternative hypothesis. **[2 marks]**

      H0: mu <= 120
      Ha: mu > 120

   c) Calculate the test statistic and find the corresponding p-value. **[1+2 marks]**

      TS = (123 – 120)/(2.65/sqrt(7)) = 2.99
      Because the value of test statistic is between $t_{6,0.01} = 3.1427$ and $t_{6,0.025} = 2.4469$, the p-value is between 0.01 and 0.025.

   d) In this example, do we need to have the Normality assumption (i.e. assuming the variable of interest has a Normal distribution)? Briefly justify your answer. **[0+1 mark]**

      Yes. We need the Normality assumption in order to use the t-distributions.

   e) Draw an appropriate conclusion, in the context of the question using 5% significance level. **[2 marks]**

      Since the p-value is less than 5% significance level, we have enough statistical evidence to reject the null hypothesis and conclude that the average systolic blood pressure (mmHg) of all blood pressure tests of John's is significantly higher than 120 mmHg.

2. Suppose typical patients after a specific minor surgery would stay in the hospital for an average of 10 days. A researcher wanted to verify if this situation has changed lately with a new minor surgery procedure. A sample of 8 most recent patients was drawn and here is the length of hospital stay (in days) after a specific minor surgery.

9	11	10	8	12	9	10	13

For your convenience, the summary statistics are $\bar{X} = 10.25$ and $s = 1.67$.
You can assume that this is a good representation of all patients after a specific minor surgery and the length of hospital stay (in number of days) follows a Normal distribution.
Subjects: patients after a specific minor surgery
Variable: length of the hospital stay (in days)
Type: numerical variable

a) Identify the parameter of interest. **[2 marks]**

Define mu as the average length of hospital stay among all patients with a specific minor surgery

b) Set up the null hypothesis and the alternative hypothesis. **[2 marks]**

H0: mu = 10
Ha: mu != 10 (or mu <> 10, or mu is not equal to 10)

c) Calculate the test statistic and find the corresponding p-value. **[1+2 marks]**

TS = (10.25 – 10)/(1.67/sqrt(8)) = 0.4234
Because the value of test statistic is smaller than $t_{7,0.20} = 0.8960$, the (one side) tail area of the test statistic is bigger than 0.20. In other words, the p-value is bigger than 2 times that, or p-value is bigger than 0.40.

d) Draw an appropriate conclusion, in the context of the question using 10% significance level. **[2 marks]**

Since the p-value is bigger than the 10% significance level, we do not have enough statistical evidence to reject the null hypothesis and conclude that the average length of hospital stay among all patients with a specific minor surgery is not significantly different from 10 days.