1. A company produces high quality chocolates which are all in the shape of circular discs. The diameter, in mm, of 33 randomly selected chocolates were

271 269 274 278 281 269 270 272 276 275 278
279 274 272 280 275 276 279 281 271 274 277
276 278 278 276 279 275 277 274 278 273 274

   Assuming that the diameters of these chocolates are normally distributed, investigate, at the 10% significance level, the hypothesis that their mean diameter has increased from 275mm

2. A new exam board is developing a GCSE Statistics course. They intend to make the mean mark obtained in the exam 65 and this will be the bench mark for a grade 6, with a standard deviation of 6.3. The main executive behind the new exam board, Mr Craig, is currently a teacher at Fullards Academy and gives his current GCSE Statistics class (following a different exam board) a specimen paper for the new course.
   All 48 pupils from Mr Craig's class took the paper and scored an average of 64.8. Carry out a hypothesis test to investigate whether the mean mark for the specimen paper is 65. It is assumed that the sample of 48 students' scores were normally distributed with the same standard deviation of 6.3marks.

3. A report was issued by 'R-8 My Stay' in 2017 which claimed that the average daily rate for a 4* hotel in Birmingham was £114.78 with a standard deviation of £30.81
   Steve regularly stays in 4* hotel in Birmingham for work and record the prices he pays for the last 12 visits.
   106 180 97 100 200 95 141 137 127 115 159 121
   Assuming that the prices Steve pays are normally distributed with the standard deviation of £30.81, test at the 5% significance level, Steve's belief that the average 4* hotel price in Birmingham is more that that claimed by 'R-8e My Stay'
   What may Steve have failed to take into account when recording his hotel prices and comparing the average calculated by 'R-8 My Stay'?

4. A car manufacturer introduces a new method of assembling a particular component. The old method had assembly times which were normally distributed with a mean of 42 minutes. The manufacturer would like the assembly time to be as short as possible, and so expects the new method to have a smaller mean. A random sample of assembly times (minutes) taken after the new method had become established was
   27 39 28 41 47 42 35 32 38
   Investigate the manufacturer's expectation using a 1% level of significance

5. A pharmaceutical company claimed that a course of its vitamin tablets would improve examination performance. To publicise its claim, the company offered to provide the tablets free to candidates taking a particular GCSE examination. This offer was taken up by some but not all of the candidates. The average mark in the examination for all candidates who did not take the course of vitamin tablets was 42.0.
   A random sample of 120 candidates from those who had taken the course of vitamin tablets gave a mean mark of 43.8 and a standard deviation of 12.8.
   Test, at the 5% significance level, whether the candidates who took the vitamin tablets had a mean mark greater than 42.0. State clearly your null and alternative hypothesis.

6. In processing grain in the brewing industry, the percentage extract recovered is measured. A brewer introduces a new source of grain and the percentage extract on 11 separate randomly selected days is as follows.
   95.2 93.1 93.5 95.9 94.0 92.0
   94.4 93.2 95.5 92.3 95.4
   Test the hypothesis that the mean percentage extract recovered is 95.0 using a 5% significance level. What assumptions have you made in carrying out your test?