1. The mean and the standard deviation of the number of marks obtained in the biology leaving certificate exam by randomly selected male and female pupils are described below:

	Number	Mean	Std. Dev.
Male	10	57	12
Female	12	61	11

   Calculate a 95% confidence interval for the difference between the mean number of marks obtained by males and females in the population of school leavers as a whole.

   Test the hypothesis that males and females on average obtain the same mark in the biology leaving certificate exam. Use a significance level of 5%. You may assume that all required assumptions have been validated.

      i. Formally state the null and alternative hypotheses.
      ii. Compute the Test Statistic.
      iii. State the appropriate Critical Value for this hypothesis test.
      iv. Discuss your conclusion to this test, supporting your statement with reference to appropriate values.

2. An environmental group states that fewer than 60% of industrial plants comply with air pollution standards. An independent researcher takes a sample of 400 plants and finds that 270 are complying with air pollution standards.

   (a) Carry out a hypothesis test to investigate the claim made by the environmental group. Clearly state your null and alternative hypotheses and your conclusion.
   (b) Compute the 95% confidence interval.
   (c) Compute the Test Statistic.
   (ii) By interpreting this confidence interval, state your conclusion about the environmental group's claim? Explain how you made this decision.

3. The following questions are concerned with important topic in hypothesis testing

      i. In the context of hypothesis testing, explain what a p-value is, and how it is used. Support your answer with a simple example.
      ii. What is meant by Type I error and Type II error?

4. The standard deviations of data sets X and Y are 10 and 9 respectively. An inference procedure was carried out to assess whether or not X and Y can be assumed to have equal variance.

      i. Formally state the null and alternative hypothesis.
      ii. The Test Statistic has been omitted from the computer code output. Compute the value of the Test Statistic.

  iii. What is your conclusion for this procedure? Justify your answer.

  iv. Explain how a conclusion for this procedure can be based on the 95% confidence interval.

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          F test to compare two variances

 data:  X and Y
 F = ......, num df = 13, denom df = 11, p-value = 0.7349
 alternative hypothesis: true ratio of variances is not equal to 1
 95 percent confidence interval:
  0.3639938 3.9475262
 sample estimates:
 ratio of variances
         .......
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5. During the early development of a medicated skin patch to help smokers break the habit, a test was conducted with 112 volunteers. Because of the so-called "placebo effect", of people tending to respond positively just because attention is paid to them, about half the volunteers were given an unmedicated skin patch. At the end of the study, the number of persons in each group who were abstinent and who were smoking are as follows:

	Abstinent	Smoking	
Medicated patch	21	36	57
Unmedicated patch	11	44	55
	32	80	112

Let π_1 and π_2 denote the probabilities of quitting smoking with the medicated and unmedicated patches, respectively.

 (i) Calculate point estimates for π_1 and π_2

 (ii) Compute the confidence interval of the difference in proportions $\pi_1 - \pi_2$

 (iii) Find a 95% confidence interval for .

 (iv) Based on the confidence interval found, can you conclude that (a) the success rate with the medicated patch is higher than for the control group that received the untreated patches? (b) the medicated patch is not very effective? Explain your answers.

  • Carry out a testing procedure to investigate the claim that the medicated patch helps smokers break the habit. State clearly the null hypothesis, alternative hypothesis, and conclusions drawn.

6. During the early development of a medicated skin patch to help smokers break the habit, a test was conducted with 112 volunteers. Because of the so-called "placebo effect", of people tending to respond positively just because attention is paid to them, about half the volunteers were given an unmedicated skin patch. At the end of the study, the number of persons in each group who were abstinent and who were smoking are as follows:

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Carry out a testing procedure to investigate the claim that the medicated patch helps smokers break the habit. State clearly the null hypothesis, alternative hypothesis, and conclusions drawn.

7. The strength of dosage of a plant growth enhancement chemical is often measured by the proportion of plants that grow faster. A particular dosage of the chemical is fed to 107 plants of these plants, 92 actually show faster growth.

(i) (1 Mark) Calculate a point estimate $\hat{p}$ for the proportion of plants that grow faster due to the dosage.

(ii) Find a 95% confidence interval for the proportion.

8. A study was carried out to compare two treatments for the flu. A total of 500 newly diagnosed flu patients were randomly assigned to one of the two treatments.

- Of the 280 assigned to the first treatment, 168 still had the flu after 2 days after diagnosis.

- Of the 220 assigned to the second treatment, 176 still had the flu after 2 days after diagnosis.

(i) (8 Marks) Test the hypothesis that the 2 day recovery rate is the same for treatment groups. Clearly state your null and alternative hypotheses and your conclusion. Use a significance level of 5%.

9. An exercise physiologist wants to determine if several short bouts of exercise provide the same benefit for cardiovascular fitness as one long bout of exercise.

60 volunteers are randomly assigned to group 1 and do standardized aerobic exercise on a stationary bicycle for 30 minutes once a day, 5 days a week. 40 volunteers are randomly assigned to group 2 and do the same exercise for 10 minutes, 3 times a day, 5 days a week. Cardiovascular fitness was measured by VO2 max (maximum oxygen consumption while exercising).

Group 1 The mean change in VO2 after 12 weeks of exercise was 2.1 for group 1 with a standard deviation of 1.7.

Group 2 The mean change in VO2 after 12 weeks of exercise was 0.7 for group 2 with a standard deviation of 1.4.

Test the hypothesis that there is no significant difference between two groups are the same. (You may assume that both populations have equal variance.)

(i) Formally state your null and alternative hypotheses.

(ii) Compute the test statistic.

(iii) Discuss your conclusion to this test, supporting your statement with reference to appropriate values.