COSC6323 - Homework 1

January 2021

Instructions

Please compile your report as a pdf from the rmd file. Submit both:
FirstName_LastName.rmd and FirstName_LastName.pdf files to the black board.

1 Task 1

A sample of 100 IQ scores produced the following statistics:
mean = 95, median = 100,
mode = 75, lower quartile = 70,
upper quartile = 120 , standard deviation = 30

Which statement(s) is (are) correct?
(1) Half of the scores is less than 95.
(2) The middle 50% of scores are between 100 and 120.
(3) One-quarter of the scores are greater than 120.
(4) The most common score is 95.

2 Task 2

Suppose that Y is a normally distributed random variable with $\mu = 10$ and $\sigma = 2$, and X is an independent random variable, also normally distributed with $\mu = 5$ and $\sigma = 5$.
Find:
(a) $P(Y > 12 \text{ and } X > 4)$
(b) $P(Y > 12 \text{ or } X > 4)$
(c) $P(Y > 10 \text{ and } X < 5)$

3 Task 3

The Poisson distribution may also be used to find approximate binomial probabilities when n is large and p is small, by letting μ be np. This method provides for faster calculations of probabilities of rare events such as exotic diseases. For example, assume the incidence rate (proportion in the population) of a certain blood disease is known to be 1%. The probability of getting exactly seven cases in a random sample of 500, where $\mu = np = (0.01)(500) = 5$, is

$$P(Y = 7) = (5^7 e^{-5})/7! = 0.1044$$

Suppose the incidence of another blood disease is 0.015. What is the probability of getting no occurrences of the disease in a random sample of 200? (Remember that $0! = 1$.)

4 Task 4

The following pose conceptual hypothesis test situations. For each situation define H_0 and H_1 so as to provide control of the more serious error. Justify your choice and comment on logical values for α.
(a) You are deciding whether you should take an umbrella to work.
(b) You are planning a proficiency testing procedure to determine whether some employees should be fired.
(c) Same as part (b) except you want to determine whether some employees deserve a special merit raise.
(d) A cigarette manufacturer is conducting a test of nicotine content in order to justify a new advertising claim.
(e) You are considering the procedure to decide guilt or innocence in a court of law.
(f) You are wondering whether you should buy a new battery for your calculator before the next statistics test.
(g) As a university administrator you are considering a policy to restrict student driving in order scholastic achievement.

5 Task 5

An experiment is considered to determine whether a new computer program will speed up the processing of credit card billing at a large bank. The mean time to process billing using the present program is 12.3 min. with a standard deviation of 3.5 min. The new program is tested with 100 billings and yielded a sample mean of 10.9 min. Assuming the standard deviation of times in the new program is the same as the old, does the new program significantly reduce the time of processing? Use $\alpha = 0.05$.