

**PGDM (IBM), 2020-24**  
**Statistics for Business Analysis,**  
**INS – 108**  
**Trimester – I, End-Term Examination: September 2022**

Time allowed: 2 Hrs  
Max Marks: 40

Roll No: \_\_\_\_\_

**Instruction:** Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means**. All other instructions on the reverse of Admit Card should be followed meticulously.

Use the tables provided for answering the questions, wherever needed.

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**Section A**

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***Attempt one of each of the four questions***  
***A1a or A1b, A2a or A2b, A3a or A3b and A4a or A4b***

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**A1a.**

**(CO-1; 5 marks)**

Military radar and missile detection systems are designed to warn a country of an enemy attack. A reliability question is whether a detection system will be able to identify an attack and issue a warning. Assume that a particular detection system has a .90 probability of detecting a missile attack. Use the binomial probability distribution to answer the following questions.

- a. If two detection systems are installed in the same area and operate independently, what is the probability that at least one of the systems will detect the attack?
- b. If three systems are installed, what is the probability that at least one of the systems will detect the attack?

**or**

**A1b.**

**(CO-1; 5 marks)**

Nine percent of undergraduate students carry credit card balances greater than \$7000 (Reader's Digest, July 2002). Suppose 10 undergraduate students are selected randomly to be interviewed about credit card usage.

- a. Is the selection of 10 students a binomial experiment? Explain.
- b. What is the probability that at least three will have a credit card balance greater than \$7000?

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**A2a.**

**(CO-3; 5 marks)**

In January 2003, the American worker spent an average of 77 hours logged on to the Internet while at work (CNBC, March 15, 2003). Assume the population mean is 77 hours, the times are normally distributed, and that the population standard deviation is 20 hours.

- a) What is the probability that in January 2003 a randomly selected worker spent fewer than 50 hours logged on to the Internet?
- b) What percentage of workers spent more than 100 hours in January 2003 logged on to the Internet?
- c) A person is classified as a heavy user if he or she is in the upper 20% of usage. In January 2003, how many hours did a worker have to be logged on to the Internet to be considered a heavy user?

**or**

**A2b.**

**(CO-3; 5 marks)**

A person must score in the upper 2% of the population on an IQ test to qualify for membership in Mensa, the international high-IQ society (U.S. Airways Attaché, September 2000). If IQ scores are normally distributed with a mean of 100 and a standard deviation of 15, what score must a person have to qualify for Mensa?

**A3a.**

**(CO-2; 5 marks)**

The mean annual cost of automobile insurance is \$950 (CNBC, February 23, 2006). Assume that the standard deviation is  $\sigma = \$250$ .

- What is the probability that a simple random sample of automobile insurance policies will have a sample mean within \$25 of the population mean for each of the following sample sizes: 100, and 400?
- What is the advantage of a larger sample size when attempting to estimate the population mean?

*or*

**A3b.**

**(CO-2; 5 marks)**

Barron's reported that the average number of weeks an individual is unemployed is 17.5 weeks (Barron's, February 18, 2008). Assume that for the population of all unemployed individuals that the population standard deviation is 4 weeks. Suppose you would like to select a random sample of 50 unemployed individuals for a follow-up study.

- Show the sampling distribution of  $\bar{x}$ , the sample mean average for a sample of 50 unemployed individuals.
- What is the probability that a simple random sample of 50 unemployed individuals will provide a sample mean within 1 week of the population mean?

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**A4a.**

**(CO-1; 5 marks)**

Individuals filing federal income tax returns prior to March 31 received an average refund of \$1060. Consider the population of "last-minute" filers who mail their tax return during the last five days of the income tax period (typically April 10 to April 15).

- A researcher suggests that a reason individuals wait until the last five days is that on average these individuals receive lower refunds than do early filers. Develop appropriate hypotheses such that rejection of  $H_0$  will support the researcher's contention.
- For a sample of 400 individuals who filed a tax return late, i.e. between April 10 and 15, the sample mean refund was \$950. Based on prior experience a population standard deviation of  $\sigma = \$1600$  may be assumed.
- At  $\alpha = .05$ , what is your conclusion?

*or*

**A4b.**

**(CO-1; 5 marks)**

In a study entitled "How Undergraduate Students Use Credit Cards", it was reported that undergraduate students have a mean credit card balance of \$3200 (Sallie Mae, April 2009). Assume that a current study is being conducted to determine if it can be concluded that the mean credit card balance for undergraduate students has increased compared to the April 2009 report. Based on a sample of 324 undergraduate students, a mean credit card balance of \$3280 was observed. The population standard deviation is  $\sigma = \$1000$ .

- a. State the null and alternative hypotheses.
  - b. Using a .05 level of significance, what is your conclusion?
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### Section B (Compulsory)

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**(CO-3, 4; 20 marks)**

- B1** State Senator Hanna Rowe has ordered an investigation of the large number of boating accidents that have occurred in the state in recent summers. Acting on her instructions, her aide, Geoff Spencer, has randomly selected 9 summer months within the last few years and has compiled data on the number of boating accidents that occurred during each of these months. The mean number of boating accidents to occur in these 9 months was 31, and the standard deviation in this sample was 9 boating accidents per month. Geoff was told to construct a 90 percent confidence interval for the true mean number of boating accidents per month, but he was in such an accident himself recently, so you will have to do this for him.
- B2** An oil refinery has backup monitors to keep track of the refinery flows continuously and to prevent machine malfunctions from disrupting the process. One particular monitor has an average life of 4,300 hours and a standard deviation of 730 hours. The average life has been arrived at using a large sample. In addition to the primary monitor, the refinery has set up two standby units, which are duplicates of the primary one. In the case of malfunction of one of the monitors, another will automatically take over in its place. The operating life of each monitor is independent of the others.
- (a) What is the probability that a given set of monitors will last at least 13,000 hours?
  - (b) At most 12,630 hours?
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