

(Marks/100)

(6) 1. True/False: Answer true (T) if the statement is always true. Answer false (F) otherwise.

a. For any set of measurements, the sum of the deviations from the mean is zero.

b. A and B are two nonempty events defined on S. If A and B have no outcomes in common, then $P(A|B) = P(A)$

c. All other things being equal, the minimum sample size required to estimate μ will be doubled if the maximum error of the estimate is halved.

d. The length of a $1 - \alpha$ confidence interval for μ is equal to $2z_{\alpha/2}\sigma_{\bar{x}}$

e. All other things being equal, a larger sample size will result in a narrower confidence interval for μ .

f. If $a < \mu_1 - \mu_2 < b$ is a $1 - \alpha$ confidence interval estimate for the difference of means of two independent population, then the maximum error of estimate is $\frac{a+b}{2}$.

(5) 2. According to Chebychev's theorem, at least 84% of all the data of a particular sample lies between 36.8 and 54.4. Find the mean and standard deviation of this sample.

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- (6) 3. Five cards are to be randomly selected from a standard deck of 52 cards.
- How many different hands of five cards are possible if the first drawn is a queen and the remaining four are not queens?

 - How many different hands of five cards are possible if the first card drawn is a queen and the remaining four are not clubs?

 - What is the probability that the event described in part b occurs?
- (3) 4. A large company wants to cut costs by firing some employees. Out of 15 employees, 5 are fired. Those five were the most senior, and therefore the highest paid. The company claims that those who were fired were chosen at random. What is the probability that the company's claim is true?
- (3) 5. Assume that 1 in 200 people carry the defective gene that causes inherited colon cancer. In a sample of 2000 individuals, what is the approximate distribution of the number who carry this gene? Use this distribution to calculate the approximate probability that at least 10 carry the gene.

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- (5) 6. Suppose that Allan can get to work three ways: He can walk to school, drive a car or ride a bus. If he walks, he has 60% chance of being late for his first class. If he drives, he has a 50% chance of being late. If he takes the bus, he has only a 20% chance of being late. It is known that Allan walks 10% of the time, he drives in 30% of the time and takes the bus the rest of the time. Find the probability that Allan drove in today if it is known that Allan arrived late.

7. Three males with a sex linked genetic disorder have one child each. The random variable x is the number of children among the three who inherit the x linked genetic disorder.

x	0	1	2	3
$P(x)$	0.4219	0.3219		0.0156

- (2) a) Find the expected number of children that will inherit this disorder.
- (2) b) Find the standard deviation in the number of children that will inherit this disorder.
- Assume the cost of caring for such a child is $25x+72$ dollars.
- (2) c) What is the variance of the amount that will be spent?

(Marks/100)

8. Suppose that 95% of all customers that walk in to a car dealership want to buy a new car. The rest want a used car. Consider a randomly selected group of 50 purchasers.

- (4) a) Find the mean and standard deviation of the number who want a new car.
- (4) b) What is the probability that the number who want a new car is more than one standard deviation away from the mean value?
- (3) c) The dealership has 62 new cars on the lot and 3 used cars. If 50 people come in one by one to purchase a car, what is the probability that all of them get a car they want from the current stock? (Assume if a person wants a new car, any new car will do and if a person wants a used car, any used car will do.) .

9. Café-La-Thé is considering opening up a coffee shop in Montreal. Previous research shows that a shop will be profitable if the mean household income of the city is greater than \$60 000. It is also known that the population standard deviation of income is \$6 000.

- (4) a) What is the probability that the sample mean of 100 homes differs from the population mean by more than \$1000?

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A random sample of 100 households was obtained and the mean income was found to be \$58 500.

- (4) b) Test, using the p-value approach, the hypothesis that the population mean is at least \$60000. (Use $\alpha=0.05$)

- (2) c) Would you recommend that Café-La-Thé open a coffee shop in Montreal? Justify your answer.

- (4) 10. Let X denote the amount of space occupied by an article placed in a packing container. The pdf of x

$$f(x) = \begin{cases} 90x^8(1-x) & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

- a. What is the probability that X is within 1 standard deviation of its mean value? (Given that $\mu = 0.8181$ and $\sigma = 0.11134$)

- b. Set up the equation to find, but do not solve for, the p th percentile.

(Marks/100)

- (4) 11. The weights of Healthy Stuff Cereal are normally distributed with a mean of 400 grams. If 5% of all cereal boxes have a weight less than 390 grams, find the standard deviation of the weights.

- (4) 12. It has been estimated that 98% of Actuarial Science students find jobs within the first few months after graduation. Find the probability that more than 99% of a random sample of 120 graduating students in fact find jobs.

13. Melanie is the manager of quality assurance for Green Valley Foods, Inc., a packer of frozen vegetable products. Melanie wants to be sure that the variation of package weights is small so that the company does not produce a large proportion of packages that are under the stated package weight. If a sample of 25 packages yields a standard deviation of 10grams,

- (4) a) obtain a 98% confidence interval for the population variance.
- (4) b) test the claim that the population variance is less than 120. (Use $\alpha=0.05$)

(Marks/100)

14. A new drug that is hoped to reduce cholesterol is on the market. Eight patients' cholesterol is measured before and after treatment with the drug. The following was observed:

<i>Patient</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>Before drug</i>	29	32	34	31	28	36	33	34
<i>After drug</i>	28	31	34	30	29	33	30	28

(2+4) a) Find a 90% confidence interval for the drop in cholesterol level.

(4) b) Does the drug, in fact, lower cholesterol? Test this claim at the 0.01 level of significance?

(4) 15. In a random sample of 99 John Abbott Basketball games the home team won 56 games. Test the hypothesis that the home team wins more than 50% of games. (Use $\alpha=0.10$)

(Marks/100)

16. In a study on the effects of marijuana use in college students, the memory of users and non users were compared by means of a memory test. Twenty-four non users had a mean memory factor of 56.12 and standard deviation of 3.6. Twenty-five users had a mean memory factor of 51.84 and a standard deviation of 6.2.

- (5) a) Test at the 0.02 level of significance that the variances are equal.
- (6) b) According to the result found in (a), test whether users scored lower on average on the memory test than non users. (Use $\alpha=0.10$)