

University of Saskatchewan
Department of Mathematics & Statistics
FINAL EXAM

STATS 244.3
 Max Time 3 hours Max. Marks 100
 Total no. of pages =10.

Instructor: Sarjinder Singh
 Date: Dec 9, 2000

Last Name _____ First Name _____ and/or ID# _____

Ex. 1.(Marks 20):

The final grades in mathematics of 10 students at the UOS are recorded as

9, 18, 19, 21, 25, 25, 21, 19, 16, 7

Choose from the following list the values of the quantities stated in questions 1 -10.

- (a) 766 (b) 5 (c) 6 (d) 10 (e) 16 (f) 18 (g) 19 (h) 21 (i) 90 (j) 25 (k) 36 (l) 180
 (m) 7 (n) 28.5 (o) 8.5 (p) 1

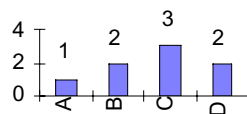
Note: more than one answers are expected to some questions.

Sample Size	90 th percentile
Mean	Range
Median	Inter-quartile range
(Sample) variance	Mode
(Sample) standard deviation	$\sum_{i=1}^{10} x_i$
Lower quartile	$\sum_{i=3}^6 x_i$
75 th percentile	$\sum_{i=1}^3 x_i^2$
Maximum value	Minimum value
Upper Quartile	Lower Inner fence
Upper inner fence	Lower outer fence

Ex-2. (Marks 25)

1. What is the title of the course STATS 244.3?
 - a. Introductory statistics
 - b. Elementary statistics
 - c. Elementary statistical concepts
2. If $n = 5$ and $p = 0.6$, the mean and variance of the binomial distribution are
 - a. $\mu = 3, \sigma^2 = 1.2$;
 - b. $\mu = 5, \sigma^2 = 3$;
 - c. $\mu = 1.2, \sigma^2 = 3$
3. The collection of all outcomes of an experiment is called:
 - a. a sample space
 - b. Intersection of events
 - c. Joint probability
4. Two equally likely events
 - a. have the same probability of occurrence
 - b. Can not occur together
 - c. have no effect on the occurrence of each other.
5. Two mutually exclusive events
 - a. have the same probability
 - b. cannot occur together
 - c. have no effect on the occurrence of each other.
6. The joint probability of two mutually exclusive events is always
 - a. 1.0
 - b. Between 0 and 1
 - c. 0
7. The binomial probability distribution is symmetric if
 - a. $p < 0.5$
 - b. $p = 0.5$
 - c. $p > 0.5$
8. The binomial distribution is skewed to left if
 - a. $p < 0.5$
 - b. $p = 0.5$
 - c. $p > 0.5$
- 9 Which of the following is not a characteristic of the normal distribution?
 - a. The total area under the curve is 1.0.
 - b. The curve is symmetric about mean
 - c. The two tails of the curve extend indefinitely
 - d. The value of the mean is always greater than the value of σ
10. For a normal distribution curve, the z-value for an x value that is less than μ is always:
 - a. Positive
 - b. Negative
 - c. 0
11. Empirical rule can be applied to:
 - a. any distribution
 - b. bell-shaped distribution only
 - c. skewed distribution only
12. A sampling distribution is the probability distribution of
 - a. a population parameter
 - b. a sample statistic
 - c. any random variable

13. The value of the middle term in the ranked data is called the:
a. mean b. median c. mode
14. Which of the following summary measures can be calculated for qualitative data?
a. mean b. median c. mode
15. Which of the following summary measures is/are influenced by extreme values?
a. mean b. median c. mode d. range
16. Which of the following can have more than one value?
a. mean b. median c. mode
17. The values of the variance and standard deviation are
a. never negative b. always positive c. never zero
18. A summary measure calculated for the population data is called :
a. a sample statistic b. a population parameter c. an outlier
19. A summary measure calculated for the sample data is called:
a. a population parameter b. a sample statistic c. a boxplot
20. The 75th percentile is a value in a ranked data set such that
a. about 75% of the values are smaller and about 25% are larger than this value.
b. about 25% of the values are smaller and about 75% are larger than this value.
21. How many different outcomes are possible for four rolls of a die?
a. 4 b. 1296 c. 256
22. How many different outcomes are possible for 10 tosses of a coin?
a. 10,000,000,000 b. 1024 c. 10
23. Which of the following values can not be probabilities of events?
a. $1/5$ b. 0.97, c. -0.35 d. 1.56, e. $5/3$ f. 0.0 g. $-2/7$ h. 1.0
24. Write down the probabilities of impossible and sure events?
25. The data display



is called (a) Histogram (b) Bar diagram (c) Box plot

Ex 3 (Marks 10). To compare two programs for training industrial workers to perform a skilled job, 18 workers are included in an experiment. Of these, 8 are selected at random and trained by method 1; the remaining 10 workers are trained by method 2. After completion of training, all the workers are subjected to a time-and-motion test records the speed of performance of a skilled job. The following data are obtained.

	Time (minutes)									
Method-1	10	15	6	18	11	16	13	11		
Method-2	18	26	8	14	18	12	23	21	20	23

- (a) Can you conclude from the data that the mean job time is significantly less after training with method-1 than after training with method-2? (Test with $\alpha=0.05$).
- (b) Construct a 95% confidence interval for the population mean difference in job times between the two methods.

Ex. 4. (Marks 10). Given these six pairs of (x,y) values:

x	1	2	3	3	4	5
y	9	5	6	3	3	1

- Calculate \bar{x} , \bar{y} , S_{xx} , S_{yy} and S_{xy} .
- Calculate the least square estimates of \hat{a} and \hat{b} .
- Determine the fitted line
- Predict the value of y when x=6.
- Guess the value and sign of correlation coefficient (r) from the scatter plot.
- Find the value of r.

Ex 5. (Marks 10). Of a group of patients who complained that they did not sleep well, some were given sleeping pills while others were given sugar pills (although they all thought they were getting sleeping pills). They were later asked whether the pills helped them or not. Assuming that all patients told the truth, test the hypothesis there is no difference between sleeping pills and sugar pills at a significance level of 0.05.

	Slept well	Did not slept well
Took sleeping pills	44	10
Took sugar pills	81	35

(a) Use χ^2 -test (b) Use Z-test (c) Show that $\chi^2 = Z^2$

Given: $\chi^2_{0.05}(df = 1) = 3.84$ and $Z_{0.025} = 1.96$

Ex 6. (Marks 10) (a) Complete the following table

	Null hypothesis (H_0) is	
Decision	True	False
Accept H_0		
Reject H_0		

(b) A population has standard deviation 10. What is the standard deviation of sample mean \bar{x} for a random sample of size

- (1) $n=25$
- (2) $n=100$
- (3) $n=400$

Ex 7.(Marks 10) (a) If a man purchases a raffle ticket, he can win a first prize of \$5000 and a second prize of \$2000 with probabilities 0.001 and 0.003. What should be a expected fair price to pay for the ticket?

(b) If x denotes the number of heads in a single toss of 4 fair coins, find

1. $P(x = 3)$
2. $P(x < 2)$
3. $P(1 < x \leq 3)$

Hint : Use binomial formula

Ex 8. (Marks 5). From the set of numbers $\{1, 3, 5\}$, a random sample of size 2 will be selected with replacement.

- (a) List all possible samples and calculate \bar{x} for each.
- (b) Determine the sampling distribution of \bar{x}

FORMULAE SHEET

<p>sample variance</p> $s^2 = \frac{\sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n}}{n-1}$ <p>CI: $\bar{x} \pm t_{\alpha/2} (df = n-1) \frac{s}{\sqrt{n}}$</p>	<p>Z-score $Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$; $IQR = Q_3 - Q_1$</p> <p>Lower inner fence $Q_1 - 1.5IQR$</p> <p>Upper inner fence $Q_3 + 1.5IQR$</p> <p>Lower outer fence $Q_1 + 3IQR$</p> <p>Upper outer fence $Q_3 + 3IQR$</p>
<p>t-test for the difference between two means (n<30)</p> $t = \frac{\bar{x}_1 - \bar{x}_2 - d}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$ $s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ <p>CI: $\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2} (df = n_1 + n_2 - 2) \sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$</p>	<p>large sample sizes (n>30)</p> $Z = \frac{\bar{x}_1 - \bar{x}_2 - d}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ $Z = \frac{p_1 - p_2 - 0}{\sqrt{pq \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$ $\bar{x}_1 - \bar{x}_2 \pm Z_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ $p = \frac{x_1 + x_2}{n_1 + n_2}, q = 1 - p$
<p>3. Correlation and regression</p> $S_{xx} = \sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n}$ $S_{yy} = \sum_{i=1}^n y_i^2 - \frac{(\sum_{i=1}^n y_i)^2}{n}$ $S_{xy} = \sum_{i=1}^n y_i x_i - \frac{(\sum_{i=1}^n y_i)(\sum_{i=1}^n x_i)}{n}$ $r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}, \hat{b} = \frac{S_{xy}}{S_{xx}}, \hat{a} = \bar{y} - \hat{b}\bar{x}$ $\hat{y}_i = \hat{a} + \hat{b}x_i$	$Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}; Z = \frac{p - P_0}{\sqrt{\frac{pq}{n}}}$ <p>CI: $\bar{x} \pm Z_{\alpha/2} \frac{s}{\sqrt{n}}$</p> <p>Binomial $P(X = x) = {}^n C_x p^x q^{n-x}$</p> <p>Chi-square</p> $\chi^2 = \sum_{i,j} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ $\mu = \sum_x xp(x)$ $\sigma^2 = \sum_x p(x)(x - \mu)^2$

Last Name _____ First Name _____

Stats 244.3 (Final Exam)