

Final Exam Review-Part 1.

1. The following information regarding the ten richest Americans was reported in a recent issue of *Forbes*.

| Name | Ranking | Worth (\$Billions) | Age | Marital Status | Source |
|------------------|---------|-----------------------|-----|-------------------|----------------------|
| Gates, William | 1 | 59.0 | 51 | married | Microsoft |
| Buffett, Warren | 2 | 52.0 | 77 | married | Berkshire Hathaway |
| Adelson, Sheldon | 3 | 28.0 | 74 | married | casinos, hotels |
| Ellison, L. J. | 4 | 26.0 | 63 | married | Oracle |
| Brin, Sergey | 5 | 18.5 | 34 | married | Google |
| Page, Larry | 5 | 18.5 | 34 | single | Google |
| Kerkorian, Kirk | 7 | 18.0 | 90 | divorced | investments, casinos |
| Dell, Michael | 8 | 17.2 | 42 | married | Dell |
| Koch, Charles | 9 | 17.0 | 71 | married | oil, commodities |
| Koch, David | 9 | 17.0 | 67 | married | oil, commodities |

- How many elements are in the above data set?
- How many variables are in this data set?
- How many observations are in this data set?
- Which variables are categorical and which are quantitative?
- What measurement scale is used for 'Ranking,' 'Marital status' and 'Source'?

ANS:

- 10
- 5
- 10
- Worth and Age are quantitative
Ranking, Marital Status, and Source are categorical
- Ranking: ordinal
Marital Status: nominal
Source: nominal

2. The following table shows the age distribution of a sample of 180 students at a local college.

AGE DISTRIBUTION OF
180 STUDENTS AT A LOCAL COLLEGE

| Age of Students | Number of Students |
|-----------------|--------------------|
| 15 - 19 | 36 |
| 20 - 24 | 44 |
| 25 - 29 | 60 |
| 30 - 34 | 38 |
| 35 - 39 | <u>2</u> |
| Total | 180 |

- a. Of the students in the sample, what percentage is younger than 20 years of age?
- b. What percentage is at least 30 years of age?
- c. Based on this sample, what percentage of the students at the college do you estimate to be younger than 25 years of age?

ANS:

- a. 20%
- b. 22.22%
- c. 44.44%

3. The highway patrol is interested in determining the average speed of automobiles traveling on I-75 between Chattanooga and Atlanta. To accomplish this task, the speed of every tenth car passing a particular point on I-75 is recorded.

- a. What is the population for this study?
- b. What constitutes the sample?
- c. Is speed a categorical or a quantitative variable?
- d. ~~What type of measurement scale is used?~~

ANS:

- a. All the automobiles on I-75
- b. All the tenth cars
- c. Quantitative
- d. Ratio

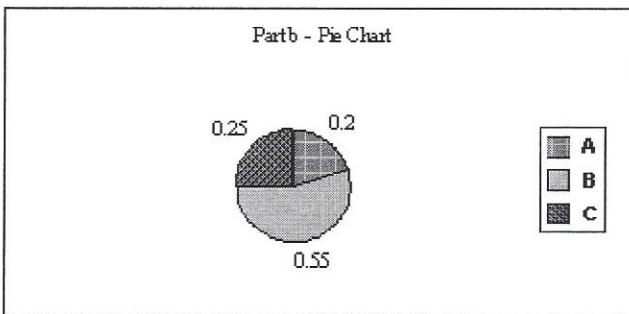
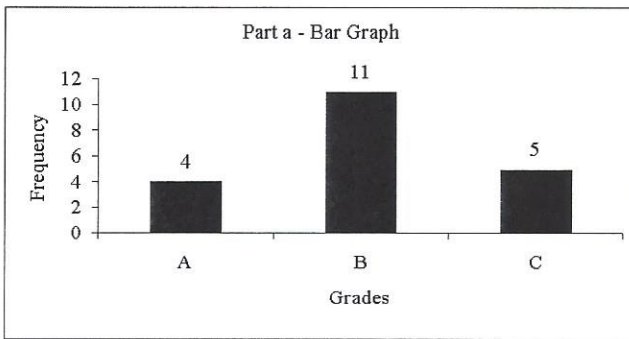
4. A student has completed 20 courses in the School of Arts and Sciences. Her grades in the 20 courses are shown below.

| | | | | |
|---|---|---|---|---|
| A | B | A | B | C |
| C | C | B | B | B |
| B | A | B | B | B |
| C | B | C | B | A |

- Develop a frequency distribution and a bar chart for her grades.
- Develop a relative frequency distribution for her grades and construct a pie chart.

ANS:
a and b

| Grade | Frequency | Relative Frequency |
|--------------|-----------|--------------------|
| A | 4 | 0.20 |
| B | 11 | 0.55 |
| C | 5 | 0.25 |
| Total | 20 | 1.00 |



5. The variance of a sample was reported to be 81. The report indicated that $\sum (x - \bar{x})^2 = 972$. What has been the sample size?

ANS:

13

6. The following data show the yearly salaries of a sample of EMBA graduates.

| EMBA Student | Salary (in \$1,000) |
|--------------|---------------------|
| A | 88 |
| B | 97 |
| C | 90 |
| D | 110 |
| E | 114 |
| F | 98 |
| G | 92 |
| H | 95 |

- Compute the mean yearly salary and **give your answer in dollars.**
- Compute the standard deviation and **give your answer in dollars.**
- Compute the 75th percentile and **give your answer in dollars.** *Fully explain what the value that you have determined indicates.*

ANS:

- \$98,000
- \$9,355.03
- \$104,000 Seventy five percent of the observations are less than or equal to this value.

Final Exam Review-Part 2

1. A bank has the following data on the gender and marital status of 200 customers.

| | Male | Female |
|---------|------|--------|
| Single | 20 | 30 |
| Married | 100 | 50 |

- What is the probability of finding a single female customer?
- What is the probability of finding a married male customer?
- If a customer is female, what is the probability that she is single?
- What percentage of customers is male?
- If a customer is male, what is the probability that he is married?
- Are gender and marital status mutually exclusive?
- Is marital status independent of gender? Explain using probabilities.

ANS:

- 0.15
- 0.5
- 0.375
- 60%
- 0.833
- No, the intersection is not zero.
- They are not independent because $P(\text{male}) = 0.6$ $P(\text{male}|\text{single}) = 0.4$

2. An applicant has applied for positions at Company A and Company B. The probability of getting an offer from Company A is 0.4, and the probability of getting an offer from Company B is 0.3. Assuming that the two job offers are independent of each other, what is the probability that

- the applicant gets an offer from both companies?
- the applicant will get at least one offer?
- the applicant will not be given an offer from either company?
- Company A does not offer her a job, but Company B does?

ANS:

- 0.12
- 0.58
- 0.42
- 0.18

3. In a city, 60% of the residents live in houses and 40% of the residents live in apartments. Of the people who live in houses, 20% own their own business. Of the people who live in apartments, 10% own their own business. If a person owns his or her own business, find the probability that he or she lives in a house.

ANS:

0.75

4. A machine is used in a production process. From past data, it is known that 97% of the time the machine is set up correctly. Furthermore, it is known that if the machine is set up correctly, it produces 95% acceptable (non-defective) items. However, when it is set up incorrectly, it produces only 40% acceptable items.
- An item from the production line is selected. What is the probability that the selected item is non-defective?
 - Given that the selected item is non-defective, what is the probability that the machine is set up correctly?

ANS:

- 0.9335
- 0.9871

5. A very short quiz has one multiple choice question with five possible choices (a, b, c, d, e) and one true or false question. Assume you are taking the quiz but do not have any idea what the correct answer is to either question, but you mark an answer anyway.
- What is the probability that you have given the correct answer to both questions?
 - What is the probability that only one of the two answers is correct?
 - What is the probability that neither answer is correct?
 - What is the probability that only your answer to the multiple choice question is correct?
 - What is the probability that you have only answered the true or false question correctly?

ANS:

- 1/10
- 5/10
- 4/10
- 1/10
- 4/10

6. Assume you are taking two courses this semester (A and B). The probability that you will pass course A is 0.835, the probability that you will pass both courses is 0.276. The probability that you will pass at least one of the courses is 0.981.
- What is the probability that you will pass course B?
 - Is the passing of the two courses independent events? Use probability information to justify your answer.
 - Are the events of passing the courses mutually exclusive? Explain.

ANS:

- 0.422
- No, $P(A|B) = 0.654 \neq P(A)$
- No, the intersection is not zero.

7. Twenty-five percent of the employees of a large company are minorities. A random sample of 7 employees is selected.

- What is the probability that the sample contains exactly 4 minorities?
- What is the probability that the sample contains fewer than 2 minorities?
- What is the probability that the sample contains exactly 1 non-minority?
- What is the expected number of minorities in the sample?
- What is the variance of the minorities?

ANS:

- 0.0577
- 0.4450
- 0.0013
- 1.75
- 1.3125

8. A random variable x has the following probability distribution:

| X | $f(x)$ |
|-----|--------|
| 0 | 0.08 |
| 1 | 0.17 |
| 2 | 0.45 |
| 3 | 0.25 |
| 4 | 0.05 |

- Determine the expected value of x .
- Determine the variance.

ANS:

- 2.02
- 0.9396

9. The following table shows part of the probability distribution for the number of boats sold daily at Boats Unlimited. It is known that the average number of boats sold daily is 1.57.

| x | f(x) |
|---|------|
| 0 | 0.20 |
| 1 | 0.30 |
| 2 | 0.32 |
| 3 | ? |
| 4 | 0.05 |
| 5 | 0.02 |

Compute the variance and the standard deviation for this probability distribution.

ANS:

Variance = 1.4051, Standard deviation = 1.1854 (rounded)

10. The daily dinner bills in a local restaurant are normally distributed with a mean of \$28 and a standard deviation of \$6.
- What is the probability that a randomly selected bill will be at least \$39.10?
 - What percentage of the bills will be less than \$16.90?
 - What are the minimum and maximum of the middle 95% of the bills?
 - If twelve of one day's bills had a value of at least \$43.06, how many bills did the restaurant collect on that day?

ANS:

- 0.0322
- 0.0322
- minimum = \$16.24 maximum = \$39.06
- 2,000

11. The price of a bond is uniformly distributed between \$80 and \$85.

- a. What is the probability that the bond price will be at least \$83?
- b. What is the probability that the bond price will be between \$81 to \$90?
- c. Determine the expected price of the bond.
- d. Compute the standard deviation for the bond price.

ANS:

- a. 0.4
- b. 0.8
- c. \$82.50
- d. \$1.44

12. The time between arrivals of customers at the drive-up window of a bank follows an exponential probability distribution with a mean of 10 minutes.

- a. What is the probability that the arrival time between customers will be 7 minutes or less?
- b. What is the probability that the arrival time between customers will be between 3 and 7 minutes?

ANS:

- a. 0.5034
- b. 0.2442

Final Exam Review-Part 3

1. In the past, the average age of employees of a large corporation has been 40 years. Recently, the company has been hiring older individuals. In order to determine whether there has been an **increase** in the average age of all the employees, a sample of 64 employees was selected. The average age in the sample was 45 years with a standard deviation of 16 years. Let $\alpha = .05$.
- State the null and the alternative hypotheses.
 - Compute the test statistic.
 - Using the p -value approach, test to determine whether or not the mean age of all employees is significantly more than 40 years.

ANS:

- $H_0: \mu \leq 40$
 $H_a: \mu > 40$
- $t = 2.5$
- p -value (.007518) is between .005 and .01; reject H_0

2. A sample of 30 cookies is taken to test the claim that each cookie contains at least 9 chocolate chips. The average number of chocolate chips per cookie in the sample was 7.8 with a standard deviation of 3.
- State the null and alternative hypotheses.
 - Using the critical value approach, test the hypotheses at the 5% level of significance.
 - Using the p -value approach, test the hypothesis at the 5% level of significance.
 - Compute the probability of a Type II error if the true number of chocolate chips per cookie is 8.
 - Find the corresponding sample size if we want to reduce the probability of type II error to 10%

ANS:

- $H_0: \mu \geq 9$
 $H_a: \mu < 9$
- test statistic $t = -2.190 < -1.699$; reject H_0
- reject H_0 ; the p -value is between .01 to .025
- $\beta = .428$.
- $n = 78$.

3. A sample of 61 items provided a sample mean of 932, a sample mode of 900, and a sample standard deviation of 11. Test the following hypotheses using $\alpha = 0.05$. What is your conclusion?

$$H_0: \sigma^2 \leq 80$$

$$H_a: \sigma^2 > 80$$

ANS:

$$\chi^2 = 90.75 > 79.082; \text{ reject } H_0$$

OR

$$p\text{-value} = .0063 \text{ is less than } 0.005: \text{ Reject } H_0$$

4. A sample of 15 items provides a sample mean of 18 and a sample variance of 16. Compute a 95% confidence interval estimate for the standard deviation of the population.

ANS:

2.93 to 6.31 (rounded)

5. A new brand of chocolate bar is being market tested. Four hundred of the new chocolate bars were given to consumers to try. The consumers were asked whether they liked or disliked the chocolate bar. You are given their responses below.

| Response | Frequency |
|-----------------|------------------|
| Liked | 300 |
| Disliked | <u>100</u> |
| | 400 |

- Construct a 80% confidence interval for the true proportion of people who liked the chocolate bar.
- For a 80% confidence interval, how large of a sample needs to be taken to provide a margin of error of 1% or less?

ANS:

a. [.722, .778]

b. n=3082