MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use Bayes' theorem to find the indicated probability.

1) (10 points) Some employers use lie detector tests to screen job applicants. Lie detector tests are not completely reliable. Suppose that in a lie detector test, 65% of lies are identified as lies and that 14% of true statements are also identified as lies.

A company gives its job applicants a polygraph test, asking "Did you tell the truth on your job a pplication?" Suppose that 93% of the job applicants tell the truth during the polygraph test. What is the probability that a person who fails the test was actually telling the truth? (In other words, what is the conditional probability of having told the truth given the lie detector says a lie was told?)

A) 0.349 B) 0.14 C) **0.741** D) 0.259

The calculation is: $\dfrac{0.14(0.93)}{0.14(0.93)+0.65(0.07)} = 0.741$.

Provide an appropriate response. Round to the nearest hundredth.

2) (10 points) Find the standard deviation for the given probability distribution.

x	P(x)
0	0.37
1	0.13
2	0.06
3	0.15
4	0.29

A) $\sigma = 1.81$ B) $\sigma = 2.90$ C) $\sigma = 2.52$ D) σ **= 1.70**

Answer: $\mu = 0(0.37)+1(0.13)+2(0.06)+3(0.15)+4(0.29) = 1.86$

$$\sigma^2 = 0.37(-1.86)^2 + 0.13(-.86)^2 + 0.06(.14)^2 + 0.15(1.14)^2 + 0.29(2.14)^2 = 2.900$$

$$\sigma = 1.70$$

Solve the problem.

3) (10 points) For a standard normal distribution, find the percentage of data that are more than 2 standard
deviations below the mean or more than 3 standard deviations above the mean.

A) **2.41%** B) 0.26% C) 4.56% D) 97.59%

Add the two probabilities: $P[Z \le -2] = 0.0228$ and $P[Z \ge 3] = [Z \le -3] = 0.0013$.

4) (10 points) In a continuous uniform distribution,

$$\mu = \frac{\min + \max}{2} \text{ and } \sigma = \frac{\text{range}}{\sqrt{12}} .$$

Find the mean and standard deviation for a uniform distribution having a minimum of -3 and a maximum of 14.

A) $\mu = 8.5$, $\sigma = 1.70 = 4.91$ B) **$\mu = 5.5$, $\sigma = 4.91$** C) $\mu = 5.5$, $\sigma = 3.18$

Answer: $\mu = \frac{-3+14}{2} = 5.5$ and $\sigma = \frac{3+14}{\sqrt{12}} = 4.91$

5) (10 points) In a hypothesis test, which of the following will cause a decrease in α , the probability of making a
type II error?

A: Increasing α while keeping the sample size n fixed
B: Increasing the sample size n, while keeping α fixed
C: Decreasing α while keeping the sample size n fixed
D: Decreasing the sample size n, while keeping a fixed:

A) B and C B) A and D C) C and D D) **A and B**

Option A will make it easier to reject the null hypothesis when it is true thus increasing the chances of finding the alternative which will reduce the probability of missing the alternative when it is true. Option B will make the test more powerful in identifying the alternative hypothesis thus reducing the chances of missing it when it is true. C and D have the opposite effect to A and B.

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p.

6) (10 points) n = 85, x = 49; 98% confidence

A) $0.471 < p < 0.681$ B) $0.470 < p < 0.682$

C) $0.450 < p < 0.702$ D) $0.451 < p < 0.701$

p = 0.5765 the confidence interval is p +- 2.33*sqrt(0.5765(0.4235)/85) which is p+-0.1249

Given the linear correlation coefficient r and the sample size n, test the null hypothesis of zero correlation at the 1.0% significance level. Use a two-tailed test. Use your finding to select the correct answer.

7) (5points) r = 0.543, n = 25

A) T= 3.101, no significant linear correlation
B) T= 3.233, significant linear correlation
C) T= 3.101, significant linear correlation
D) T= 3.233, no significant linear correlation

Refer to page 174 Basic Statistics. $T = 0.543\sqrt{\frac{23}{1-0.543^2}} = 3.101$ $|T| >$ t=2.807 with df=23 at the 0.005% level.

8) (5 points) r = -0.25, n = 90

A) T= -2.450 , significant linear correlation
B) T= -2.422, significant linear correlation
C) T= 2.450, no significant linear correlation
D) T = -2.422, no significant linear correlation

Refer to page 174 Basic Statistics. $T = -0.25\sqrt{\frac{88}{1-(-0.25)^2}} = -2.422$ $|T| <$ t=2.633 with df=88 at the 0.005% level.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Test the indicated claim about the means of two populations. Assume that the two samples are independent simple random samples selected from normally distributed populations. Do not assume that the population standard deviations are equal. Use the traditional method or P-value method as indicated.

9) (15 points) A researcher was interested in comparing the resting pulse rates of people who exercise
regularly and of those who do not exercise regularly. Independent simple random samples of 16 people who do not exercise regularly and 12 people who exercise regularly were selected, and the resting pulse rates (in beats per minute) were recorded. The summary statistics from the random samples are as follows.

Do not exercise regularly	Exercise regularly
x_1 = 73.0 beats/min	x_2 = 68.4 beats/min
s_1 = 10.9 beats/min	s_2 = 8.2 beats/min
n_1 = 16	n_2 = 12

Use a 0.025 significance level to test the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly. Use the traditional method of hypothesis testing.

Answer: H_0: $\mu_1 = \mu_2$ H_1: $\mu_1 > \mu_2$
Test statistic: t = 1.274 Critical value: t = 2.060
Do not reject H_0. At the 2.5% significance level, there is not sufficient evidence to support the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly.

Test the claim that the samples come from populations with the same mean. Assume that the populations are normally

distributed with the same variance.

10) (15 points) Random samples of four different models of cars were selected and the gas mileage of each car was measured. The results are shown below

Model A	Model B	Model C	Model D

23	28	30	25
25	26	28	26
24	29	32	25
26	30	27	28

Test the claim that the four different models have the same population mean.
Use a significance level of 0.05.

Answer: Refer to pages 421-422 of Business Statistics. This is a one-way ANOVA.
Test statistic: F = 6.435. Critical value: F = 3.4903. P-value: p = 0.00762.
Reject the claim of equal means. The different models do not appear to have the same mean.