College of the Canyons **Name:** Solutions
A. Morrow **Math 140 Exam 3**

Answer the following questions NEATLY. Show all necessary work directly on the exam. Scratch paper will be discarded unread. *Multiple Choice – 2 pts each (#1-5). Fill-in – 6 pts each part. Total points: 130.*

1) Which is true about a 95% confidence interval based on a given sample?
   I. The interval contains 95% of the population.
   II. Results from 95% of all samples will lie in the interval.
   III. The interval is narrower than a 98% confidence interval would be.

   Circle one.

   A. I only
   B. II only
   C. III only
   D. II and III only
   E. None

2) Based on a random sample of 50 students, the 90 percent confidence interval for the mean amount of money students spend on lunch at a certain high school is found to be ($3.45, $4.15). Which of the following statements is true?

   A. 90% of the time, the mean amount of money that all students spend on lunch at this high school will be between $3.45 and $4.15.
   B. 90% of all students spend between $3.45 and $4.15 on lunch at this high school.
   C. 90% of all random samples of 50 students obtained at this high school would result in a sample mean amount of money students spend on lunch between $3.45 and $4.15.
   D. Approximately 45 of the 50 students in the random sample will spend between $3.45 and $4.15 on lunch at this high school.
   E. About 90% of all random samples of 50 students obtained at this high school would result in a confidence interval that contains the true mean amount of money students spend on lunch.

3) A pharmaceutical company investigating whether food markets or drug stores are less likely to remove over-the-counter drugs from the shelves when the drugs are past the expiration date found a P-value of 2.8%. This means that:

   A. 2.8% of food markets remove over-the-counter drugs from the shelves when the drugs are past the expiration date
   B. Food markets remove 2.8% more over-the-counter drugs from the shelves when the drugs are past the expiration date than drug stores.
   C. There is a 2.8% chance that the food markets remove more expired over-the-counter drugs.
   D. There is a 2.8% chance the drug stores remove more expired over-the-counter drugs.
   E. None of these.

4) A contact lens wearer read that the producer of a new contact lens boasts that their lenses are cheaper than contact lenses from another popular company. The null hypothesis H_0: $\mu_{old} - \mu_{new} = 0$ is tested against the alternative H_A: $\mu_{old} - \mu_{new} > 0$. Which of the following would be a Type II error?

   A. Deciding that the new lenses are cheaper, when in fact they really are.
   B. Deciding that the new lenses are cheaper, when in fact they are not.
   C. Deciding that the new lenses are not really cheaper, when in fact they are.
   D. Deciding that the new lenses are not really cheaper, when in fact they are not.
   E. A Type II error is irrelevant.

5) We are about to test a hypothesis using data from a well-designed study. Which is true?

I. A small P-value would be strong evidence against the null hypothesis.
II. We can set a higher standard of proof by choosing a 10% significance level instead of 5%.
III. If we reduce the alpha level, we reduce the power of the test.

Circle one.

A. I only
B. II only
C. III only
D. I and III only
E. None

6) On many highways state police officers conduct inspections of driving logbooks from large trucks to see if the trucker has driven too many hours in a day. At one truck inspection station they issued citations to 49 of 348 truckers that they reviewed.

a) Based on the results of this inspection station, construct a 95% confidence interval for the proportion of truck drivers that have driven too many hours in a day.

(.104, .177) or (.106, .182)

b) Interpret the interval you provided in (a).

We are 95% confident that between 10% and 18% of truckers have driven too many hours in a day.

c) Is there evidence to suggest that more than 10% of truckers have driven too many hours in a day?

Yes, the interval is above 10.0%.

7) A professor asked a random sample of 10 students which subject they liked best: Math or English. Three students said math. Explain why we cannot perform inference (confidence intervals and hypothesis tests) to determine the percent that prefer math with this sample.

We do not meet the success/failure condition.
successes = 3 ≤ 10.

8) Using the data below, construct a 95% confidence interval for the proportion difference of black drivers and white drivers stopped by the police.

	Race and Ethnicity	
	Black and Non-Hispanic	White and Non-Hispanic
Drivers stopped by police	24	147
Total number of observed drivers	200	1400
Percent Stopped by Police	**12.0%**	**10.5%**

a) Construct a 95% confidence interval.

(-3%, 6%)

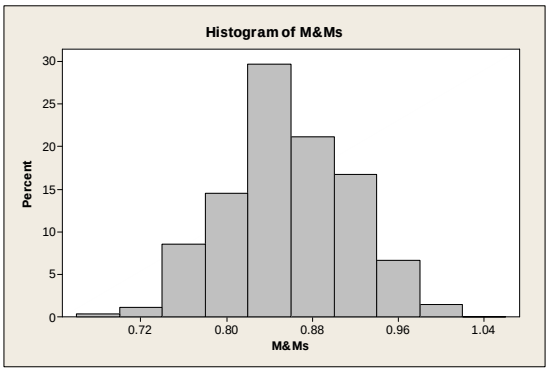
b) Interpret your interval.

We are 95% confident that the proportion difference is between -3% and 6%.

c) Does evidence suggest that the proportion of black drivers stopped by the police is greater than the proportion of white drivers who are stopped?

No; negative numbers are included in the interval.

9) A sample of 27 blue M&Ms has a mean of 0.84 g and a standard deviation of 0.06. Their histogram is shown to the right. Is there evidence that the candies weighdifferently from the 0.85 g reported on the bags?



a) Hypotheses

$H_0: \mu = .85$

$H_A: \mu \neq .85$

b) Check Conditions

Independence - we must assume this 10% - 27 M&Ms is less than 10% of all blue M&Ms
Randomization - must assume
Nearly normal - the histogram verifies this.

c) Draw and shade model

d) Test statistic and p-value

$t = -.87$ $P = .394$

e) State conclusions (both statistical and experimental).

Fail to Reject H_0 (p-value is large).
There is no evidence that blue M&Ms weigh differently than marked on the package.

f) If your conclusion is wrong, what kind of error have you made?

Type II error

g) In the context of this problem, what would it mean to make a Type I error?

We determine the M&Ms weigh differently, but they actually do not.

h) In the context of this problem, what would it mean to make a Type II error?

We determine the M&Ms don't weigh differently, but they actually do.

i) As a consumer of M&M's, which error is worse to you?

Type II ... we don't want to be cheated.

10) A survey conducted of 100 randomly selected people in the United States yielded the results shown in the table below for favorite color. Is there evidence that the distribution of favorite color is different for each gender?

	Blue	**Red**	**Yellow**
Male	25	20	25
Female	5	10	15

a) Hypotheses

H_0: the distribution of favorite color is the same for each gender

H_A: they are different

b) Check conditions

Independence - assumed

Random — stated in problem

Expected Cells - smallest is 9, which is more than 5.

Counted Data - ✓

c) Provide the test statistic and P-value.

$\chi^2 = 3.770$ $P = .152$

d) State your conclusions (both the statistical and experimental).

Fail to Rej. H_0 (p-value is high)

There is no evidence that the distributions are different.