Name ________________________

Student Number ________________________

# University of Toronto in Mississauga

## June Examinations 2005
## STA 220F
## Duration - 2 hours

Aids allowed: Calculator and Textbook (Photocopies okay), Handwritten formula sheet (One sheet, two-sided)

**Questions are worth 2.5 points each**.

1. The length of time it takes a person to find a parking spot in a parking lot follows a normal distribution with a mean of 3.5 minutes and a standard deviation of 1 minute. Find the probability that a randomly selected person will take between 2.0 and 4.5 minutes to find a parking spot.

   (a) .4938
   (b) .2255
   (c) .7745 ■
   (d) .0919
   (e) .4432
   (f) .3413

2. The probability of rejecting $H_0$ just by chance if $H_0$ is true is

   (a) $\alpha$ ■
   (b) $\beta$
   (c) $\mu$
   (d) $\sigma^2$
   (e) $\int \xi(\omega)\lambda(d\omega)$
   (f) None of the above

3. Let $A$ and $B$ be events, with $P(A) = 0.75$, $P(B) = 0.20$ and $P(A^c \cap B^c) = 0.05$. What is $P(A \cap B)$? Are $A$ and $B$ independent?

   (a) $P(A \cap B) = 0$, No ■
   (b) $P(A \cap B) = 0$, Yes
   (c) $P(A \cap B) = 0.15$, No
   (d) $P(A \cap B) = 0.15$, Yes
   (e) $P(A \cap B) = 0.90$, No
   (f) $P(A \cap B) = 0.90$, Yes
   (g) Impossible to tell

**Continued on Page 2**

4. A shoe manufacturer has developed a new technology that will make tennis shoes last much longer than the current technology enables. The technology involves a thin layer of a new chemical that is applied to the sole of the shoe after the production process is complete. To test this new technology, 15 tennis players were randomly selected. Each tennis player is given a new set of tennis shoes, only one of which is treated with the new chemical. Each tennis player is then asked to record the number of hours of wear before each shoe wears out. For each tennis player, both a treated and untreated hours of wear measurement is recorded. The results were then compared across all tennis players. Some of the data appear below:

| Tennis Player | Treated Shoe | Untreated Shoe |
|---|---|---|
| 1 | 213 | 185 |
| 2 | 305 | 265 |
| ⋮ | ⋮ | ⋮ |

Which one of these assumptions is necessary for the $t$ test to be valid?

(a) $n \geq 30$
(b) The population of paired differences must be approximately normally distributed. ■
(c) The population variances must be approximately normally distributed.
(d) The population means must be approximately normally distributed.
(e) Both populations must be approximately normally distributed.
(f) None of these listed, since the Central Limit Theorem can be applied.
(g) Impossible to tell

5. The amount of corn chips dispensed into a 16-ounce bag by a dispensing machine has been identified as possessing a normal distribution with a mean of 16.5 ounces and a standard deviation of 0.1 ounce. Suppose 400 bags of chips were randomly selected from this dispensing machine. Find the probability that the sample mean weight of these 400 bags exceeded 16.6 ounces.

(a) .1915
(b) .1587
(c) .1915
(d) .6915
(e) .3085
(f) approximately 0 ■
(g) approximately 1
(h) Impossible to tell

**Continued on Page 3**

6. Which piece of information listed below does the Central Limit Theorem allow us to disregard when working with the sampling distribution of the sample mean?

   (a) The standard deviation of the population
   (b) The shape of the population distribution curve ■
   (c) The mean of the population
   (d) All can be disregarded when the Central Limit Theorem is used.
   (e) Impossible to tell

7. Consider the following set of data for salaries in East Coast fish plants

| | Men | Women |
|---|---|---|
| Sample Size | 100 | 80 |
| Mean | \$12,850 | \$13,000 |
| Standard Deviation | \$345 | \$500 |

   We wish to determine whether the mean salary of men is different from the mean salary of women. Give the value of the test statistic, and state whether there is a significant difference at the $\alpha = 0.01$ significance level.

   (a) $Z = 2.283$, Yes
   (b) $Z = 2.283$, No ■
   (c) $Z = 48.16$, Yes
   (d) $Z = 48.16$, No
   (e) $Z = 2.576$, Yes
   (f) $Z = 2.576$, No
   (g) $Z = 2.326$, Yes
   (h) $Z = 2.326$, No
   (i) Impossible to tell

8. A random sample of n = 25 observations is drawn from a population with mean 70 and standard deviation 20. What is $P(\overline{X} > 62)$?

   (a) .5000
   (b) .0228
   (c) .8413
   (d) .9772
   (e) Impossible to tell ■

**Continued on Page 4**

9. Suppose a 90% confidence interval for $\mu$ turns out to be (190, 270). Based on the interval, do you believe the population mean is equal to 280?

   (a) Yes, and I am 100% sure of it.
   (b) Yes, and I am 90% sure of it.
   (c) No, and I am 100% sure of it.
   (d) No, and I am 90% sure of it. ■
   (e) Yes, and I am 10% sure of it.
   (f) Yes, because $P(190 \leq \mu \leq 270) = 0.10$
   (g) No, because $P(190 \leq \mu \leq 270) = 0.90$
   (h) Impossible to tell

10. Here is a comparison of cholesterol levels for 28 heart attack victims and 30 individuals who did not have a heart attack. Pretend that these are random samples and that cholesterol levels are normally distributed.

```
TWOSAMPLE T FOR Attack VS CONTROL
          N      MEAN     STDEV   SE MEAN
Attack   28     253.9      47.7       9.0
CONTROL  30     193.1      22.3       4.1

95 PCT CI FOR MU Attack - MU CONTROL: (41.4, 80.2)

TTEST MU Attack = MU CONTROL (VS NE): T= 6.29  P=0.0000  DF=  56

POOLED STDEV =       36.8
```

Do you reject $H_0$ at $\alpha = 0.001$? Is there a statistically significant difference in mean cholesterol levels?

   (a) Yes, Yes ■
   (b) Yes, No
   (c) No, Yes
   (d) No, No
   (e) Impossible to tell from this output.

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11. A group of 50 men (group 1) and 40 women (group 2) were asked if they thought sex discrimination is a problem in Canada. Eleven of the men and 19 of the women said they believed that sexual discrimination is a problem. Find the value of the test statistic.

    (a) z = -.85
    (b) z = -1.05
    (c) z = -1.20
    (d) z = -2.55 ■
    (e) z = -5.13
    (f) z = 1.96

12. Suppose you believe that a special educational program will have some effect on the dropout rate of disadvantaged youngsters. Your null hypothesis is

    (a) Program has no effect on dropout rate ■
    (b) $H_0 = 0$
    (c) Program will decrease dropout rate
    (d) Program will increase dropout rate
    (e) Program will affect dropout rate, but the nature of the effect is unspecified.

13. A business college computing center wants to determine the proportion of students who have personal computers at home. If the proportion differs from 35%, then the lab will modify a proposed enlargement of its facilities. Suppose a hypothesis test is conducted and the test statistic is 2.6. Find the p-value for a two-tailed test of hypothesis. At $\alpha = 0.05$, Do you conclude that the percentage of students with PCs is different from 35%?

    (a) .0094 ; Yes ■
    (b) .4953 ; Yes
    (c) .0047 ; Yes
    (d) .4906 ; Yes
    (e) .9953 ; Yes
    (f) .0094 ; No
    (g) .4953 ; No
    (h) .0047 ; No
    (i) .4906 ; No
    (j) .9953 ; No
    (k) Impossible to tell

**Continued on Page 6**

14. An "outlier" is an unusually large or small observation. One definition of Unusual is for the $Z$-score to exceed 3 in absolute value. Suppose we draw a random sample of size n=96 from a normal population, and the population is so large that there is no real difference between sampling with replacement and sampling without replacement. What is the probability that *none* of the observations is deemed an outlier?

    (a) 0.0013
    (b) 0.0026
    (c) 0.2292
    (d) 0.4987
    (e) 0.7788 ■
    (f) 0.9974
    (g) 0.9987

15. Do motivation levels between Japanese and American managers differ? A randomly selected group of each were administered the Sarnoff Survey of Attitudes Toward Life (SSATL), which measures motivation for upward mobility. Suppose the p-value is .0344. Which of the following conclusions is correct using $\alpha = .02$?

    (a) Reject $H_0$, conclude Japanese managers are more motivated.
    (b) Fail to reject $H_0$, conclude Japanese managers are more motivated.
    (c) Accept $H_0$, conclude Japanese managers are more motivated.
    (d) Reject $H_0$, conclude Japanese and American managers are equally motivated.
    (e) Fail to reject $H_0$, conclude Japanese and American managers are equally motivated.
    (f) Accept $H_0$, conclude Japanese and American managers are equally motivated.
    (g) Reject $H_0$, insufficient evidence to conclude that Japanese and American managers differ in their average motivation level.
    (h) Fail to reject $H_0$, insufficient evidence to conclude that Japanese and American managers differ in their average motivation level. ■
    (i) Accept $H_0$, insufficient evidence to conclude that Japanese and American managers differ in their average motivation level.

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16. An experiment was conducted to determine the effect of different meatloaf recipes upon the amount of material that dripped out of the meatloaf during cooking; it's better when less drips out. Amount of drip loss is assumed to be normally distributed with equal variances. Here is some Minitab output.

```
MTB > oneway c1 c2

ANALYSIS OF VARIANCE ON DRIPLOSS
SOURCE     DF        SS        MS         F         p
RECIPE     2      16.26      8.13      3.44    0.051
ERROR      21      49.69      2.37
TOTAL      23      65.94
                                    INDIVIDUAL 95 PCT CI'S FOR MEAN
                                    BASED ON POOLED STDEV
 LEVEL      N      MEAN     STDEV   --+---------+---------+---------+----
     1      8     4.610     1.561    (--------*---------)
     2      8     5.465     1.362           (---------*--------)
     3      8     6.619     1.675                     (--------*---------)
                                    --+---------+---------+---------+----
POOLED STDEV =    1.538             3.6       4.8       6.0       7.2
```

Do you reject the null hypothesis of no average difference in average drip loss at $\alpha = 0.05$? What do you conclude?

(a) Yes, Recipe One best
(b) Yes, Recipe Three best
(c) Yes, All three Recipes produce the same average amount of drip
(d) Yes, Insufficient evidence to conclude the Recipes produce different average amounts of drip
(e) No, Recipe One best
(f) No, Recipe Three best
(g) No, All three Recipes produce the same average amount of drip
(h) No, Insufficient evidence to conclude the Recipes produce different average amounts of drip ■

17. Let the continuous random variable $X$ be uniformly distributed from $c = 0$ to $d = 4$. What is $P(X > 3|X > 2)$

(a) 1/2 ■
(b) 1/3
(c) 1/4
(d) 1/5
(e) 1/6
(f) 0.3183102
(g) More information needed to determine the answer.

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18. Suppose that repeated samples were selected from a population and the sample variance was calculated for each. The distribution of these sample variances would be called the ________________.

    (a) standard error of the sampling distribution
    (b) standard error of the sample mean
    (c) standard error of the sample variance
    (d) mean of the sampling distribution
    (e) sampling distribution of $\overline{X}$
    (f) sampling distribution of $S^2$ ■
    (g) sampling distribution of $\sigma^2$

19. If the expected value of a sampling distribution is not located at the parameter it is estimating, then we call that sampling distribution ________________.

    (a) inconsistent
    (b) consistent
    (c) biased ■
    (d) unbiased
    (e) random
    (f) minimum variance
    (g) insufficient
    (h) sufficient

20. Suppose that a random sample of 20 measurements is selected from a population with mean $\mu = 49$ and variance $\sigma^2 = 49$. What is the mean and standard deviation of the sampling distribution of the sample mean?

    (a) 48, 4.472
    (b) 7, 4.950
    (c) 59, 2.214
    (d) 49, 7
    (e) 7, 7
    (f) 49, 1.565 ■
    (g) Impossible to tell

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21. Which of the following statements about the sampling distribution of the sample mean is *not* correct?

    (a) the sampling distribution is approximately normal whenever the sample size is sufficiently large ($n \geq 30$).

    (b) The standard deviation of the sampling distribution is $\sigma$. ■

    (c) The mean of the sampling distribution is $\mu$.

    (d) The sampling distribution is generated by repeatedly taking samples of size n and computing the sample means.

22. In a test of the hypothesis $H_0 : \mu = 20$ versus $H_a : \mu > 20$, a sample of n = 50 observations possessed the mean $\overline{X} = 19.4$ and standard deviation $S = 3.1$. Find the p-value for this test.

    (a) 0.0853

    (b) 0.0869

    (c) 0.1706

    (d) 0.9131

    (e) 0.9147 ■

    (f) Impossible to tell

23. The registrar's office at UTM would like to estimate the average commute time and determine a 95% confidence interval for the average commute time of evening university students from their usual starting point to campus. A member of the staff randomly chooses a parking lot and selects the first 150 evening students who park in the chosen lot starting at 5:00 p.m. The confidence interval is

    (a) Meaningful because the sample size exceeds 30 and the central limit theorem ensures normality of the sampling distribution of the sample mean.

    (b) Not meaningful because the sampling distribution of the sample mean is not normal.

    (c) Meaningful because the sample is representative of the population.

    (d) Not meaningful because of the lack of random sampling. ■

    (e) Not meaningful because of possible Bayesian hierarchical cluster sampling

    (f) Impossible to contain the population parameter with the specified probability

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24. Forty-five CEOs from the electronics industry were randomly sampled and a 90% confidence interval for the average salary of all electronics CEOs was constructed. The interval was from $95,136 to $110,372. Give a practical interpretation of the interval above.

   (a) 90% of the electronics industry CEOs have salaries that fall between $95,136 and $110,372.
   (b) 90% of the sampled CEOs salaries fell in the interval $95,136 to $110,372.
   (c) We are 90% confident that the mean salary of all the electronics industry CEOs falls in the interval $95,136 to $110,372. ■
   (d) We are 90% confident that the mean salary of the sampled CEOs falls in the interval $95,136 to $110,372.
   (e) $P(95,136 \leq \mu \leq 110,372) = 0.90$
   (f) Impossible: Statement is meaningless.

25. A trade school is considering a change in the way students pay for their education. Presently, the students pay $16 per credit hour. The university is contemplating charging each student a set fee of $240 per quarter, regardless of how many credit hours each takes. To see if this proposal would be economically feasible, the university would like to know how many credit hours, on the average, each student takes per quarter. A random sample of 250 students yields a mean of 14.5 credit hours per quarter and a standard deviation of 1.7 credit hours per quarter. Estimate the mean credit hours per student per quarter using a 99% confidence interval.

   (a) $14.5 \pm .212$
   (b) $14.5 \pm .018$
   (c) $14.5 \pm .013$
   (d) $14.5 \pm .277$ ■
   (e) Impossible to tell

26. As an aid in the establishment of personnel requirements, the director of a hospital wishes to estimate the mean number of people who are admitted to the emergency room during a 24-hour period. The director randomly selects 81 different 24-hour periods and determines the number of admissions for each. For this sample, $\overline{X} = 16.1$ and $S^2 = 25$. Which of the following assumptions is necessary in order for a confidence interval to be valid?

   (a) The population sampled from has an approximate t distribution.
   (b) The population sampled from has an approximate normal distribution.
   (c) The mean of the sample equals the mean of the population.
   (d) The variance of the sample equals the variance of the population.
   (e) None of these assumptions is necessary. ■
   (f) All of these assumptions are necessary except the one about the $t$ distribution.

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27. Find the value $t_0$ such that the following statement is true: $P(-t_0 \leq t \leq t_0) = .90$ where $df = 14$.

    (a) 2.145
    (b) 1.345
    (c) 2.624
    (d) 1.761 ■
    (e) 1.350
    (f) Impossible to tell

28. Given $H_0$: $\mu = 25$, $H_a$: $\mu \neq 25$, and $p = 0.041$. Do you reject or fail to reject $H_0$ at the 0.01 level of significance? Are the results statistically significant?

    (a) reject $H_0$ ; yes
    (b) fail to reject $H_0$ ; yes
    (c) reject $H_0$ ; no
    (d) fail to reject $H_0$ ; no ■
    (e) not sufficient information to decide

29. A bus is scheduled to stop at a certain bus stop every 30 minutes. At the end of the day, buses still stop after every 30 minutes, but because delays often occur earlier in the day, the bus is never early and likely to be late. The director of the bus line claims that the length of time a bus is late is uniformly distributed and that the maximum time that a bus is late is 20 minutes. If the director's claim is true, what is the probability that the last bus on a given day will be more than 14 minutes late?

    (a) 0.35
    (b) 0.3 ■
    (c) 0.7
    (d) 0.67
    (e) 0.20

30. In a blind taste test, consumers choose which of two cola drinks they prefer. Of 200 consumers who took part in the study, 114 preferred Brand $A$ over Brand $B$. The test statistic is

    (a) $Z = 0.07$
    (b) $Z = 0.57$
    (c) $Z = 0.99$
    (d) $Z = 1.98$ ■
    (e) $Z = 14$
    (f) $Z = 28$
    (g) Impossible to answer without more information.

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31. You are interested in purchasing a new car. One of the many points you wish to consider is the resale value of the car after 5 years of ownership. Since you are particularly interested in a certain foreign sedan, you decide to estimate the resale value of this car with a 99% confidence interval. You manage to obtain data on 17 recently resold 5 year old foreign sedans of that model. These 17 cars were resold at an average price of $12,700 with a standard deviation of $600. What is the correct form of a 99% confidence interval for the true mean resale value of a 5 year old specific foreign sedan? You may assume that resale values have an approximately normal distribution.

   (a) 12,700 $\pm 2.921(\frac{600}{\sqrt{16}})$
   (b) 12,700 $\pm 2.575(\frac{600}{\sqrt{17}})$
   (c) 12,700 $\pm 2.921(\frac{600}{\sqrt{17}})$ ■
   (d) 12,700 $\pm 2.898(\frac{600}{\sqrt{17}})$
   (e) Impossible to tell

32. An industrial supplier has shipped a truckload of teflon lubricant cartridges to an aerospace customer. The customer has been assured that the mean weight of these cartridges is in excess of the 10 ounces printed on each cartridge. To check this claim, a sample of n = 10 cartridges are randomly selected from the shipment and carefully weighed. Summary statistics for the sample are: $\overline{X}$ = 10.11 ounces, s = .30 ounce. To determine whether the supplier's claim is true, consider the test, $H_0$: $\mu = 10$ vs. $H_a$: $\mu > 10$ where $\mu$ is the true mean weight of the cartridges. Assuming a normal distribution, find the rejection region for the test using $\alpha = .01$.

   (a) $t > 2.821$, where $t$ depends on 9 df ■
   (b) $t > 3.25$, where $t$ depends on 9 df
   (c) $z > 2.33$
   (d) $|z| > 2.58$
   (e) $t > 2.821$, where $t$ depends on 10 df
   (f) $t > 3.25$, where $t$ depends on 10 df
   (g) $t > 1.159502$, where $t$ depends on 10 df
   (h) $|t| > 1.159502$, where $t$ depends on 10 df
   (i) $|t| > 1.159502$, where $t$ depends on 9 df
   (j) Impossible to tell

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33. The American "Scholastic Aptitude Test" (SAT) is used as one criterion for admission to university. It has a Verbal score and a Math score. We are interested in whether there is a difference in population mean Verbal scores and Math scores. A random sample of 200 first-year university students was selected. Here is some Minitab output. The variable `diff` is the difference between Verbal SAT and Math SAT for each student. I did two t-tests. One is right and the other one is wrong. You decide.

```
Worksheet retrieved from file: grades.MTW
MTB > let c4 = c1-c2
MTB > name c4 'diff'

TEST OF MU =  0.00 VS MU N.E.  0.00

             N      MEAN    STDEV   SE MEAN        T    P VALUE
diff       200    -53.88    84.22      5.96    -9.05     0.0000


MTB > twosample ttest c1 c2;
SUBC> pooled.

TWOSAMPLE T FOR VERBAL VS MATH
          N      MEAN     STDEV   SE MEAN
VERBAL  200     595.7      73.2       5.2
MATH    200     649.5      66.3       4.7

95 PCT CI FOR MU VERBAL - MU MATH: (-67.6, -40.1)

TTEST MU VERBAL = MU MATH (VS NE): T= -7.71  P=0.0000  DF=  398

POOLED STDEV =       69.9
```

What is the value of the test statistic? What do you conclude?

(a) -9.05, Average Math scores are higher ■
(b) -9.05, Average Verbal scores are higher
(c) -9.05, Insufficient evidence to conclude there is a difference between average Verbal and Math.
(d) -7.71, Average Math scores are higher
(e) -7.71, Average Verbal scores are higher
(f) -7.71, Insufficient evidence to conclude there is a difference between average Verbal and Math.

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34. A drug company claims that 9 out of 10 doctors (i.e., 90%) recommend brand Z for their patients who have children. To test this claim against the alternative that the actual proportion of doctors who recommend brand Z is less than 90%, a random sample of doctors was taken. Suppose the test statistic is z = -1.95. Can we conclude that $H_0$ should be rejected at the $\alpha = 0.05$ level? What do you conclude?

   (a) No, Percentage is More than 90%
   (b) No, Percentage is Less than 90%
   (c) No, Percentage = 90%
   (d) Yes, Percentage is More than 90%
   (e) Yes, Percentage is Less than 90% ■
   (f) Yes, Percentage = 90%
   (g) Impossible to tell

35. It has been estimated that the 2004 G-car obtains a mean of 35 miles per gallon (MPG) on the highway, and the company that manufactures the car claims that it exceeds the estimate in highway driving. To support its assertion, the company randomly selects 38 G-cars and records the mileage obtained for each car over a driving course similar to that used to obtain the estimate. The following data resulted: $\overline{X} = 36.6$ miles per gallon, $S = 5.1$ miles per gallon. Give the alternative hypothesis in words and symbols.

   (a) The G-car gets less than 35 MPG ; $\mu = 35$
   (b) The G-car gets more than 35 MPG ; $\mu = 35$
   (c) The G-car gets 35 MPG ; $\mu = 35$
   (d) The G-car gets less than 35 MPG ; $\mu < 35$
   (e) The G-car gets more than 35 MPG ; $\mu > 35$ ■
   (f) The G-car gets 35 MPG ; $\mu \leq 35$
   (g) The G-car gets less than 36.6 MPG ; $\mu = 36.6$
   (h) The G-car gets more than 36.6 MPG ; $\mu = 36.6$
   (i) The G-car gets 36.6 MPG ; $\mu = 36.6$
   (j) The G-car gets less than 36.6 MPG ; $\mu < 36.6$
   (k) The G-car gets more than 36.6 MPG ; $\mu > 36.6$
   (l) The G-car gets 36.6 MPG ; $\mu \leq 35$
   (m) Impossible to tell

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36. A bottling company needs to produce bottles that will hold 12 ounces of liquid for a local brewery. Periodically, the company gets complaints that their bottles are not holding enough liquid. To test this claim, the bottling company randomly samples 23 bottles and finds the average amount of liquid held by the 23 bottles is 11.6 ounces with a standard deviation of .2 ounce. Calculate the appropriate test statistic.

    (a) t = -4.290
    (b) t = -46.000
    (c) t = -9.592
    (d) t = -9.381
    (e) Analysis may be inappropriate – seek more information. ■

37. According to advertisements, a strain of soybeans planted on soil prepared with a specified fertilizer treatment has a mean yield of 475 bushels per acre. Twenty farmers who belong to a cooperative plant the soybeans. Each uses a 40-acre plot and records the mean yield per acre. The mean and variance for the sample of 20 farms are $\overline{X} = 462$ and $S^2 = 9070$. Specify the null and alternative hypothesis used to determine if the mean yield for the soybeans is different than advertised.

    (a) $H_0$: $\mu = 462$ vs. $H_a$: $\mu \neq 462$
    (b) $H_0$: $\mu = 462$ vs. $H_a$: $\mu > 462$
    (c) $H_0$: $\mu = 462$ vs. $H_a$: $\mu < 462$
    (d) $H_0$: $\mu = 462$ vs. $H_a$: $\mu \geq 462$
    (e) $H_0$: $\mu = 462$ vs. $H_a$: $\mu \leq 462$
    (f) $H_0$: $\mu \leq 462$ vs. $H_a$: $\mu > 462$
    (g) $H_0$: $\mu \geq 462$ vs. $H_a$: $\mu < 475$
    (h) $H_0$: $\mu = 475$ vs. $H_a$: $\mu \neq 475$ ■
    (i) $H_0$: $\mu = 475$ vs. $H_a$: $\mu > 475$
    (j) $H_0$: $\mu = 475$ vs. $H_a$: $\mu < 475$
    (k) $H_0$: $\mu = 475$ vs. $H_a$: $\mu \geq 475$
    (l) $H_0$: $\mu = 475$ vs. $H_a$: $\mu \leq 475$
    (m) $H_0$: $\mu \leq 475$ vs. $H_a$: $\mu > 475$
    (n) $H_0$: $\mu \geq 475$ vs. $H_a$: $\mu < 475$
    (o) Impossible to tell without more information.

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38. A method currently used by doctors to screen women for possible breast cancer fails to detect cancer in 15% of the women who actually have the disease. A new method has been developed that researchers hope will be able to detect cancer more accurately. A random sample of 76 women known to have breast cancer were screened using the new method. Of these, the new method failed to detect cancer in twelve. Specify the null and alternative hypotheses that the researchers wish to test. Answer: To determine if the new method is more accurate in detecting cancer than the old method, we test:

(a) $H_0 : p = .15$ vs. $H_a : p < .15$ ■
(b) $H_0 : p = .15$ vs. $H_a : p > .15$
(c) $H_0 : p = .15$ vs. $H_a : p \neq .15$
(d) $H_0 : p = 0.1578947$ vs. $H_a : p < 0.1578947$
(e) $H_0 : p = 0.1578947$ vs. $H_a : p > 0.1578947$
(f) $H_0 : p = .15$ vs. $H_a : p \neq .15$
(g) $H_0 : p = 0.1578947$ vs. $H_a : p \neq 0.1578947$
(h) Impossible to tell

39. A university dean is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 118 of them are receiving financial aid. Use a 95% confidence interval to estimate the true proportion of students on financial aid.

(a) $.59 \pm .002$
(b) $.59 \pm .005$
(c) $.59 \pm .05$
(d) $.59 \pm .068$ ■
(e) $.59 \pm .474$
(f) $.59 \pm .95$
(g) Impossible to tell

**Continued on Page 17**

40. The owner of Get-A-Away Travel has recently surveyed a random sample of 279 customers of the agency. She would like to determine whether or not the mean age of the agency's customers is over 24. If so, she plans to alter the destination of their special cruises and tours. If not, no changes will be made. The appropriate hypotheses are $H_0$: $\mu = 24$, $H_a$: $\mu > 24$. If she concludes the mean age is over 24 when it is not, she makes a ________________ error. If she concludes the mean age is not over 24 when it is, she makes a ________________ error.

(a) Type I; Type II ■

(b) Type I; Type I

(c) Type II; Type I

(d) Type II; Type II

(e) Errors of inference are impossible for this sample size because of the Central Limit Theorem.

(f) Impossible to tell

**Forty Questions, 2.5 points each:**
**Total marks = 100 points**