AMS 102.3 FINAL PRACTICE EXAM
EACH PROBLEM HAS ONLY ONE CORRECT ANSWER.
FILL IN YOUR ANSWER IN THE ANSWER SHEET.

Name:_____ **ID:**_____

Question 1 A study sponsored by by American Express Co. and the French government tourist office found that old stereotypes about French unfriendliness were not true. The respondents were more than 1000 Americans who have visited France more than once for pleasure over the past two years. The results of this study are probably
A) biased, understating the extent to which the old stereotypes were not true.
B) biased, overstating the extent to which the old stereotypes were not true.
C) very accurate, given the large sample size.
D) very inaccurate because the sample is only a small fraction of all Americans who have visited France.

Use the following paragraph for Questions 2 and 3.
A market research company wishes to find out whether the population of students at a university prefers brand A or brand B of instant coffee. A random sample of students is selected, and each one is asked to try brand A first and then brand B (or vice versa, with the order determined at random). They then indicate which brand they prefer.

Question 2 This is an example of
A) an random allocation experiment.
B) an observational study.
C) an pair-design experiment.
D) an double blind experiment.

Question 3 The response variable is:
A) whether brand A and B is tried first.
B) the two brands of coffee.
C) which brand they prefer.
D) the identity of the student.

Use the following to answer Questions 4 to 7:
A noted psychic was tested for ESP. The psychic was presented with 100 cards down and asked to determine if the card was one of four symbols: spade, heart, diamond and club. The psychic was correct in 30 cases. Let p represent the probability that the psychic correctly identifies the symbol on the card in a random trial.

Question 4 Based on the results of the test, a 95% error margin of $\hat{p}$ is
A) above 0.1.
B) between 0.05 and 0.1.
C) between 0.02 and 0.05.
C) below 0.01.

Question 5 Suppose that we wish to see if there is evidence that the psychic is doing better than guessing. The null hypothesis and the alternative hypothesis are
A)$H_0 : p = 0.20,\ \ H_a : p > 0.20.$
B)$H_0 : p = 0.25,\ \ H_a : p > 0.25.$
C)$H_0 : p = 0.30,\ \ H_a : p > 0.30.$
D)$H_0 : p = 0.50,\ \ H_a : p > 0.50.$

Question 6 The P-value of the test is:
A) Above 0.10
B) between 0.05 and 0.10
C) between 0.01 and 0.05
D) below 0.01.

Question 7 I toss a penny and observe whether it lands heads up or tails up. Suppose the probability of heads is 1/2 and the probability of tails is 1/2. This means
A) every occurrence of a head must be balanced by a tail in the next toss.
B) Regardless of the number of flips, half will be heads and half tails.
C) if I flip the coin many many times the proportion of heads will be approximately 1/2, and this proportion will tend to get closer and closer to 1/2 as the number of tosses increases.
D) All of the above.

Question 8 The sampling distribution of a statistic is
A) the extent to which the sample results differ systematically from the truth.
B) the probability that we obtain the statistic in repeated random samples.
C) the mechanism that determines whether or not randomization was effective.
D) the distribution of values taken by a statistic in all possible samples of the same size from the same population.

Question 9 We know that The random variable $\bar{X}$ is approximately normal distribution for large sample because of
A) the law of large numbers.
B) the central limit theorem.
C) the law of proportions.
D) the fact that probability is the long run proportion of times an event occurs.

Use the following for Questions10-12.
An simple random sample of 9 postal employees found that the average time these employee had worked for the postal service was $\bar{x} = 7$ years with standard deviation $s = 2$ years. Assume the distribution of the time the population of employees have worked for the postal office is approximately normal with mean μ. Are these data evidence that μ has changed from the value of 7.5 years of 20 years ago? The make this determination we test the hypotheses

$$H_0 : \mu = 7.5,\ \ H_a : \mu \neq 7.5$$

Question 10 The appropriate test procedure for this problem is
A)One sample Z-test.
B)Two sample Z-test.
C)One sample T-test.
D)Two independent sample T-test.

Question 11 A 95% confidence interval for the mean time μ the population of postal service employees have spent with the postal service is:
A) 7± 0.67.
B) 7± 1.53.
C) 7± 1.96.
D) 7± 2.3.

Question 12 Which of the following could have negative values.
A) P-value
B) variance
C) standard deviation
D) Z-test statistics

Use the following paragraph for Questions 13-14:
An automobile insurer has found that repair claims have a mean of $920 and a standard deviation of $870. Suppose that the next 100 claims can be regarded as a random sample from the long-run claims process.

Question 13 The mean and standard deviation of the average the next 100 claims is
A) mean = $920 and standard deviation = $87.
B) mean = $920 and standard deviation = $8.70.
C) mean = $92 and standard deviation = $87.
D) mean = $92 and standard deviation = $870.

Question 14 The probability that the average of the 100 claims is larger than $1000 is
A) 0.9200.
B) 0.8212.
C) 0.0800.
D) 0.1788.

Use the following paragraph for Questions:15-16
A marketing research firm wishes to determine if the adult men in Laramie, Wyoming, would be interested in a new upscale men's clothing store. From a list of all residential addresses in Laramie, the firm selects a simple random sample of 100 and mails a brief questionnaire to each.

Question 15 The population in this study is
A) all adult men in Laramie, Wyoming.
B) all residential addresses in Laramie, Wyoming.
C) the members of the marketing firm who actually conducted the survey.
D) the 100 addresses the survey was mailed to.

Question 16 The sample in this study is
A) all adult men in Laramie, Wyoming.
B) all residential addresses in Laramie, Wyoming.
C) the members of the marketing firm who actually conducted the survey.
D) the 100 addresses the survey was mailed to.

Use the following for Question 17-18.
Twenty per-med students are randomly divided into two groups. One group took a popular preparing program for MCAT while the other one prepared the exam on their own. All students took the same MCAT exam. The researcher would like to known if there is evidence that the program improves the MCAT scores. Let μ_1 be the average MCAT score among those who go through the program, and μ_2 be the average score among those who do not.

Question 17 We would use:
A) one sample t test.
B) one sample z test.
C) paired t test
D) none of above.

Question 18 The alternative hypothesis is:
A) $\mu_1 \neq \mu_2$.
B) $\mu_1 < \mu_2$.
C) $\mu_1 > \mu_2$.
D) $\mu \neq 0$.

Question 19 Which of the following study is most appropriate for paired design.
A) Compare two treatments for armpit odor.
B) Compare two treatments for lung cancer.
C) Compare two methods for quitting smoke.
D) Compare two treatments for back pain.

Question 20 Suppose we are testing the null hypothesis $H_0 : \mu = 50$ and the alternative $H_a : \mu \neq 50$ for a normal population with known $\sigma = 6$. A random sample of nine observations are drawn from the population and we find the sample mean of these observations is $\bar{x} = 53$. Which of the following test procedure should we use to find out the P-value.
A) One Sample T-test
B) One Sample Z-test
C) Paired T-test.
D) Two Independent Sample T-test.

Question 21 Suppose we are testing the null hypothesis $H_0 : \mu = 50$ and the alternative $H_a : \mu \neq 50$ for a normal population with unknown σ. A random sample of nine observations are drawn from the population and we find the sample mean of these observations is $\bar{x} = 53$ and the sample standard deviation is $s = 6$. Which of the following test procedure should we use to find out the P-value.
A) One Sample T-test
B) Z-Test
C) Paired T-test
D) Two Independent Sample T-test.

Question 22 The P-value of a test of a null hypothesis is
A) the probability, assuming the null hypothesis is false, that the test statistic will take a value at least as extreme as that actually observed.
B) the probability, assuming the null hypothesis is true, that the test statistic will take a value at least as extreme as that actually observed.
C) the probability the null hypothesis is true.
D) the probability the null hypothesis is false.

Question 23 A university administrator obtains a sample of the academic records of past and present scholarship athletes at the university. The administrator reports that no significant difference was found in the mean GPA (grade point average) for male and female scholarship athletes (P = 0.287). This means
A) the chance of obtaining a difference in GPAs between male and female scholarship athletes as large as that observed in the sample, if there is no difference in mean GPAs, is 0.287.
B) the chance that a pair of randomly chosen male and female scholarship athletes would have a significant difference in GPAs is 0.287.
C) The chance that the GPAs for male and female scholarship athletes are identical are different is 28.7.
D) The chance that their is no difference in GPAs between male and female scholarship athletes is 0.287.

Use the following for Question 24-25
Let X be the outcome of rolling a carefully made six-sided die. Assuming the die is fair, the probability distribution for X is as follows.

Value of X	1	2	3	4	5	6
Probability	1/6	1/6	1/6	1/6	1/6	1/6

Question 24 The probability of rolling a value greater than three is
A) 1/6.
B) 1/3.
C) 1/2.
D) 2/3.

Question 25 P(X $\leq$ 2) has value
A) 1/6.
B) 1/3.
C) 1/2.
D) 2/3.

Question 26 A study is conducted to determine if one can predict the yield of a crop based on the amount of fertilizer applied to the soil. The response variable in this study is
A) yield of the crop.
B) amount of fertilizer applied to the soil.
C) the experimenter.
D) amount of rainfall or any other variable that may explain the yield.

Question 27 A description of different houses on the market includes the following three variables. Which of the variables is quantitative?
A) The square footage of the house
B) The monthly gas bill
C) The monthly electric bill
D) All of the above.

Question 28 The variability of a statistic is described by
A) the spread of its sampling distribution.
B) the amount of bias present.
C) the vagueness in the wording of the question used to collect the sample data.
D) the stability of the population it describes.

Question 29 Which of the following does NOT describe t-distributions correctly.
A) T-distribution is bell shaped.
B) T-distribution has smaller tails than normal distribution.
C) T-distribution of 100 degree of freedom is very close to standard normal distribution.
D) T-distribution is symmetric.

Question 30 A paired T-test was performed to test the null hypothesis $H_0 : \mu_D = 0$ versus the alternative $H_1 : \mu_D \neq 0$. The observed test statistic is $t = 1.8$, based on sample size 18. What we can best say is that the P-value of the test is
A)between 0.01 and 0.025
B)between 0.02 and 0.05
C)between 0.025 and 0.05
D)between 0.05 and 0.10

Use the following for Questions 31 to 37.
The values in the accompanying list are measured maximum breadth of male Egyptian skulls from different epochs (based on data from *Ancient Races of the Thebaid*, by Thompson and Randall-Maciver). The researchers would like to know whether or not there are changes in head shape over time. Presence of the change would suggest that interbreeding occurred with immigrant population.

4000 B.C. 131 138 125 129 132 135 132 134 138 127
1850 B.C. 129 134 137 137 129 136 138 134
150 A.D. 128 138 136 139 141 142 137 145 137 143

An ANOVA procedure is performed. The MINITAB output is given below.

```
One-way Analysis of Variance

Analysis of Variance
Source     DF        SS        MS        F        P
Factor      2     218.2     109.1     5.94    0.008
Error      25     458.8      18.4
Total      27     677.0
                                 Individual 95% CIs For Mean
                                 Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
4000BC     10    132.10      4.33  (-------*-------)
1850BC      8    134.25      3.54        (--------*-------)
150AD      10    138.60      4.74                    (-------*-------)
                                 -+---------+---------+---------+-----
Pooled StDev =     4.28         129.5     133.0     136.5     140.0
```

Question 31 The median of the 10 skulls from 4000 B.C. is
A) 132.
B) 132.10.
C) 133.
D) 133.5.

Question 32 From the MINITAB output, the sample standard deviation of the 8 skulls from 1850 B.C. is
A)3.54.
B)4.28.
C)4.33.
D)4.74.

Question 33 The null hypothesis of the ANOVA procedure is
A) that the average size of the skulls increased over the time.
B) that the average size of the skulls decreased over the time.
C) that the average size of the skulls changed over the time.
D) that the average size of the skulls did not changed over the time.

Question 34 The alternative hypothesis of the ANOVA procedure is
A) that the average size of the skulls increased over the time.
B) that the average size of the skulls decreased over the time.
C) that the average size of the skulls changed over the time.
D) that the average size of the skulls did not changed over the time.

Question 35 From MINITAB output, F-test Statistic is
A) 5.94
B) 0.008
C) 10
D) 2 and 25.

Question 36 For this example, we notice that
A) the data suggest a violation of assumption that the three population have the equal variance.
B) ANOVA is not appropriate for this data because the sample size of three group are not the same.
C) ANOVA is not appropriate because the sample size is too small.
D) the data show strong evidence that the average size of the skulls changed over the time.

Question 37 The degrees of freedom of the test
A) are 8 and 10.
B) are 2 and 25.
C) are 2 and 27.
D) are 25 and 27.

Use following paragraph for Questions 38 to 40.
A restaurant owner found that 60% of his customer order appetizer and 40% of his customers order dessert, 25% of his customers order both appetizer and dessert. (hint: use a Venn Diagram)

Question 38 For a randomly selected customer, what is the probability that he will only order dessert but not appetizer?
A) 10%. B) 15% C) 25% D)35%.

Question 39 For a randomly selected customer, what is the probability that he will order neither dessert nor appetizer?
A) 0%. B) 15% C)25% D)35%.

Question 40 A customer sits down and ordered appetizers, what is the conditional probability that he will also order desserts?
A) below 20%, B)between 20% and 40%, C)between 40% and 60%, D)above 60%.

Addition Rule: $P(A \cup B) = P(A) + P(B) - P(AB)$, Conditional Probability: $P(A|B) = P(A \cap B)/P(B)$

$E(X) = \mu = \sum x_i p(x_i)$, $\sigma^2 = Var(X) = \sum (x_i - \mu)^2 p(x)$, $\sigma = sd(X) = \sqrt{Var(X)}$

Standardized Variable $Z = \dfrac{X - \mu}{\sigma}$,

Sampling Distribution of $\bar{X}$:

$\mu_{\bar{X}} = \mu$, $\sigma^2_{\bar{X}} = \dfrac{\sigma^2}{n}$, $sd(\bar{X}) = \dfrac{\sigma}{\sqrt{n}}$, $Z = \dfrac{\bar{X} - \mu}{\sigma/\sqrt{n}}$ is approximately $N(0,1)$ for large n

Sampling Distribution of $\hat{p}$:

$\mu_{\hat{p}} = p$, $\sigma^2_{\hat{p}} = \dfrac{p(1-p)}{n}$, $sd(\bar{X}) = \sqrt{\dfrac{p(1-p)}{n}}$, $\hat{p}$ is approximately $N(p, \sqrt{\frac{p(1-p)}{n}})$ for large n.

Values of z^*

$1-\alpha$	0.80	0.85	0.90	0.95	0.99
z^*	1.28	1.44	1.645	1.96	2.58

One Sample Z-Procedures:

$100(1-\alpha)\%$ error margin for $\bar{X}$ is $z^*\sigma/\sqrt{n}$.

$100(1-\alpha)\%$ confidence interval for μ is $(\bar{X} - z^*\frac{S}{\sqrt{n}}, \bar{X} + z^*\frac{S}{\sqrt{n}})$ or $(\bar{X} - z^*\frac{\sigma}{\sqrt{n}}, \bar{X} + z^*\frac{\sigma}{\sqrt{n}})$

Test Statistics: $Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$ or $Z = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$

One Sample Z-Procedures for Proportions:

$100(1-\alpha)\%$ error margin for $\hat{p}$ is $z^*\sqrt{\frac{\hat{p}\hat{q}}{n}}$.

$100(1-\alpha)\%$ confidence interval for p is $(\hat{p} - z^*\sqrt{\frac{\hat{p}\hat{q}}{n}}, \hat{p} + z^*\sqrt{\frac{\hat{p}\hat{q}}{n}})$

Test Statistics: $Z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0/n}}$

One Sample T-Procedures:

$100(1-\alpha)\%$ error margin for $\bar{X}$ is $t^*S/\sqrt{n}$.

$100(1-\alpha)\%$ confidence interval for μ is $(\bar{X} - t^*\frac{S}{\sqrt{n}}, \bar{X} + t^*\frac{S}{\sqrt{n}})$

Test Statistics: $T = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$

Degree of freedom: n-1

Two Sample T-Procedures:

$100(1-\alpha)\%$ confidence interval for $\mu_1 - \mu_2$:

$\bar{X} - \bar{Y} \pm t^{(df)}_{\alpha/2}\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$, $d.f. = min(n_1 - 1, n_2 - 1)$

or $\bar{X} - \bar{Y} \pm t^{(df)}_{\alpha/2} S_{pooled}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$, $d.f. = n_1 + n_2 - 2$

Test Statistics: $T = \dfrac{\bar{X} - \bar{Y}}{S_{pooled}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$

Paired T-Test Statistics: $T = \frac{\bar{D}}{S_D/\sqrt{n}}$