AP Statistics Chapter 11/12 Practice Test

Name: ___________________________ Period:______

1. In preparing to use a t procedure, suppose we were not sure if the population was normal. In which of the following circumstances would we not be safe using a t procedure?
(a) A stemplot of the data is roughly bell shaped.
(b) A histogram of the data shows moderate skewness.
(c) A stemplot of the data has a large outlier.
(d) The sample standard deviation is large.
(e) The t procedures are robust, so it is always safe.

2. The weights of 9 men have mean $\bar{x}$ = 175 pounds and standard deviation s = 15 pounds. What is the standard error of the mean?
(a) 58.3
(b) 19.4
(c) 5
(d) 1.7
(e) None of the above. The answer is ______________________________.

3. What is the critical value t^* that satisfies the condition that the t distribution with 8 degrees of freedom has probability 0.10 to the right of t^*?
(a) 1.397
(b) 1.282
(c) 2.89
(d) 0.90
(e) None of the above. The answer is ______________________________.

5. The diameter of ball bearings is known to be normally distributed with unknown mean and variance. A random sample of size 25 gave a mean 2.5 cm. The 95% confidence interval had length 4 cm. Then

(a) The sample variance is 4.86.
(b) The sample variance is 26.03.
(c) The population variance is 4.84.
(d) The population variance is 23.47.
(e) The sample variance is 23.47.

6. Bags of a certain brand of tortilla chips claim to have a net weight of 14 ounces. Net weights actually vary slightly from bag to bag and are normally distributed with mean μ. A representative of a consumer advocate group wishes to see if there is any evidence that the mean net weight is less than advertised and so intends to test the hypotheses
H_0: μ = 14, H_a: μ < 14.
To do this, he selects sixteen bags of this brand at random and determines the net weight of each. He finds the sample mean to be $\bar{x}$ = 13.82 and the sample standard deviation to be s = 0.24.

We conclude that we would
(a) Reject H_0 at significance level 0.10 but not at 0.05.
(b) Reject H_0 at significance level 0.05 but not at 0.025.
(c) Reject H_0 at significance level 0.025 but not at 0.01.
(d) Reject H_0 at significance level 0.01.
(e) Fail to reject H_0 at the α = 0.10 level.

7. You want to compute a 90% confidence interval for the mean of a population with unknown population standard deviation. The sample size is 30. The value of t^* you would use for this interval is

(a) 1.96
(b) 1.645
(c) 1.699
(d) .90
(e) 1.311
(f) None of the above

8. A 95% confidence interval for the mean reading achievement score for a population of third-grade students is (44.2, 54.2). The margin of error of this interval is

(a) 95%
(b) 5
(c) 2.5
(d) 10
(e) The answer cannot be determined from the information given.

9. The effect of acid rain upon the yield of crops is of concern in many places. In order to determine baseline yields, a sample of 13 fields was selected, and the yield of barley (g/400m^2) was determined. The output from SAS appears below:

```
                                                  QUANTILES(DEF=4)         EXTREMES
  N       13       SUM WGTS      13     100% MAX   392     99%   392    LOW  HIGH
MEAN     220.231   SUM         2863      75% Q3    234     95%   392    161   225
STD DEV  58.5721   VAR      3430.69      50% MED   221     90%   330    168   232
SKEW     2.21591   KURT     6.61979      25% Q1    174     10%   163    169   236
USS       671689   CSS      41168.3       0% MIN   161      5%   161    179   239
CV       26.5958   STD MEAN  16.245                         1%   161    205   392
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A 95% confidence interval for the mean yield is:

(a) $220.2 \pm 1.96(58.6)$
(b) $220.2 \pm 1.96(16.2)$
(c) $220.2 \pm 2.18(58.6)$
(d) $220.2 \pm 2.18(16.2)$
(e) $220.2 \pm 2.16(16.2)$

12. The water diet requires one to drink two cups of water every half hour from when one gets up until one goes to bed, but otherwise allows one to eat whatever one likes. Four adult volunteers agree to test the diet. They are weighed prior to beginning the diet and after six weeks on the diet. The weights (in pounds) are

Person	1	2	3	4
Weight before the diet	180	125	240	150
Weight after six weeks	170	130	215	152

For the population of all adults, assume that the weight loss after six weeks on the diet (weight before beginning the diet – weight after six weeks on the diet) is normally distributed with mean μ. To determine if the diet leads to weight loss, we test the hypotheses

$$H_0: \mu = 0,\ H_a: \mu > 0.$$

Based on these data we conclude that

(a) We would not reject H_0 at significance level 0.10.
(b) We would reject H_0 at significance level 0.10 but not at 0.05.
(c) We would reject H_0 at significance level 0.05 but not at 0.01.
(d) We would reject H_0 at significance level 0.01.
(e) The sample size is too small to allow use of the t procedures.

13. The heights (in inches) of males in the United States are believed to be normally distributed with mean μ. The average height of a random sample of 25 American adult males is found to be $\bar{x} = 69.72$ inches and the standard deviation of the 25 heights is found to be $s = 4.15$. The standard error of $\bar{x}$ is

(a) 0.17
(b) 0.69
(c) 0.83
(d) 1.856
(e) 2.04

The next two questions refer to the following situation: In some mining operations, a byproduct of the processing is mildly radioactive. Of prime concern is the possibility that release of these byproducts into the environment may contaminate the freshwater supply. There are strict regulations for the maximum allowable radioactivity in supplies of drinking water, namely an average of 5 picocuries per liter (pCi/L) or less. However, it is well known that even safe water has occasional hot spots that eventually get diluted, so samples of water are assumed safe unless there is evidence to the contrary. A random sample of 25 specimens of water from a city's water supply gave a mean of 5.39 pCi/L and a standard deviation of 0.87 pCi/L.

14. The appropriate null and alternative hypotheses are:
(a) H_0: $\mu = 5.39$ vs H_a: $\mu \neq 5.39$
(b) H_0: $\mu = 5.39$ vs H_a: $\mu < 5.00$
(c) H_0: $\mu = 5$ vs H_a: $\mu = 5.39$
(d) H_0: $\mu = 5$ vs H_a: $\mu < 5$
(e) H_0: $\mu = 5$ vs H_a: $\mu > 5$

15. The value of the test statistic, the rejection region ($\alpha = 0.05$), and the *P*-value (computed by a computer) are:
(a) $z = 2.24$; reject if $z^* > 1.960$; *P*-value = 0.0125
(b) $z = 2.24$; reject if $z^* > 1.645$; *P*-value = 0.0125
(c) $t = 2.24$ with 25 df; reject if $t^* > 1.708$; *P*-value = 0.0171
(d) $t = 2.24$ with 24 df; reject if $t^* > 1.711$; *P*-value = 0.0173
(e) $t = 2.24$ with 24 df; reject if $t^* > 2.064$; *P*-value = 0.0173

16. Which of the following is an example of a matched pairs design?
(a) A teacher compares the pretest and posttest scores of students.
(b) A teacher compares the scores of students using a computer based method of instruction with the scores of other students using a traditional method of instruction.
(c) A teacher compares the scores of students in her class on a standardized test with the national average score.
(d) A teacher calculates the average of scores of students on a pair of tests and wishes to see if this average is larger than 80%.
(e) None of these.

18. You are thinking of using a *t* procedure to test hypotheses about the mean of a population using a significance level of 0.05. You suspect that the distribution of the population is not normal and may be moderately skewed. Which of the following statements is correct?
(a) You should not use the *t* procedure because the population does not have a normal distribution.
(b) You may use the *t* procedure provided your sample size is large, say at least 50.
(c) You may use the *t* procedure, but you should probably claim only that the significance level is 0.10.
(d) You may not use the *t* procedure. *t* procedures are robust to nonnormality for confidence intervals but not for tests of hypotheses.
(e) You may use the *t* procedure provided that there are no outliers.

Answers to MC Problems

Chapter 11

1	c
2	c
3	a
4	a
5	e
6	d
7	c
8	b
9	d
12	a
13	c
14	e
15	d
16	a
18	b

Chapter 11 Practice Free Response

1. Mutual fund performance. Many mutual funds compare their performance with that of a benchmark, an index of the returns on all securities of the kind the fund buys. The Vanguard International Growth Fund, for example, takes as its benchmark the Morgan Stanley EAFE (Europe, Australasia, Far East) index of overseas stock market performance. Here are the percent returns for the fund and for the EAFE from 1982 (the first full year of the fund's existence) to 2000.

Year	Fund	EAFE	Year	Fund	EAFE
1982	5.27	−0.86	1992	−5.79	−11.85
1983	43.08	24.61	1993	44.74	32.94
1984	−1.02	7.86	1994	0.76	8.06
1985	56.94	56.72	1995	14.89	11.55
1986	56.71	69.94	1996	14.65	6.36
1987	12.48	24.93	1997	4.12	2.06
1988	11.61	28.59	1998	16.93	20.33
1989	24.76	10.80	1999	26.34	27.30
1990	−12.05	−23.20	2000	−8.60	−13.96
1991	4.74	12.50			

Does the fund significantly outperform its benchmark?

(a) Explain clearly whether the matched-pairs *t* test or the two-sample *t* test is the proper choice to answer this question.

(b) Carry out the appropriate test and state your conclusion about the fund's performance.

1. Does the EAFE Fund do better than its benchmark?

(a) The matched-pairs t-test (performed on the differences between EAFE and Fund) is the correct test to use in this case because the variable of interest is "mean difference between EAFE and its benchmark." The matched-pairs design should be used because it controls for overall market effects experienced each year by both funds. In a given year, for instance, both funds may be down, but the EAFE may perform better.

(b) "Carry out the appropriate test"

Step 1: Population: The group of differences between the EAFE and the Vanguard International Fund from the year 1982 through 2000.

Parameter: The mean of the differences for each year between EAFE and the Vanguard Fund, taken Fund minus EAFE; μ_{diff}

Ho: On average, there is no difference each year between the EAFE and Vanguard funds; $\mu_{diff} = 0$

Ha: The fund outperforms its EAFE benchmark; $\mu_{diff} > 0$

Step 2: Test: A 1-sample t-test for means performed on the annual differences

Conditions: SRS? We must be willing to assume that these differences (see data table below) are a simple random sample of all such differences from the beginning of the funds' existence and into the future.

Normality of the population of differences? (Really, "Shall we proceed with a t-test?") Mean is -.835, while Median is -2.06. Given the range, this may not be significant. A boxplot reveals moderate skew, and an NPP is quite linear. All of this, coupled with a sample size of 19, indicates that a one-sample t-test would not be inappropriate. Proceed.

	Difference: Fund - EAFE
1982	6.13
1983	18.47
1984	-8.88
1985	0.22
1986	-13.23
1987	-12.45
1988	-16.98
1989	13.96
1990	11.15
1991	-7.76
1992	6.06
1993	11.8
1994	-7.3
1995	3.34
1996	8.29
1997	2.06
1998	-3.4
1999	-0.96
2000	5.36

These differences are now the variable on which you'll do a one-sample t-test.

Step 3: The t-statistic is $\dfrac{\bar{x}-\mu_0}{S_x/\sqrt{n}}$, or $\dfrac{.8358-0}{9.99/\sqrt{19}}$, which equals .3646. We should expect a positive t-score if the EAFE fund were doing better than its benchmark. It is positive, but is it significantly so? P(t > .3646) = .3598 (NOTE—BY COINCIDENCE, P is about equal to t-score. This is only a coincidence!!!). Such a large p-value suggests this is not significant at any reasonable significance level. Fail to reject Ho.

Step 4: Evidence from this sample does not suggest that the EAFE fund is outperforming the Vanguard fund to a significant level.