Stats 2B03 Test #2 (Version 1)
March 17th, 2015

Name:_____
(Last Name) (First Name)

Student Number:_____

This test consists of 18 multiple choice questions worth 1 mark each (no part marks), and one question worth one mark on proper computer card filling. Questions must be answered on the COMPUTER CARD with an HB PENCIL. Marks will not be deducted for wrong answers (i.e., there is no penalty for guessing). You are responsible for ensuring that your copy of the test is complete. Bring any discrepancy to the attention of the invigilator. Only the McMaster standard calculator Casio fx-991 is allowed.

1. In a study of human blood types in nonhuman primates, a sample of 71 orangutans were tested and 14 were found to be blood type B. Test the hypothesis that the proportion of orangutans that are blood type B is less than 30%, using the 10% signficance level.

(a) Reject H_0 since the p-value is equal to .0658, which is less than .10
(b) Reject H_0 since $-2.11 < -1.28$
(c) Reject H_0 since the p-value is equal to $.0174$, which is less than.10
(d) Reject H_0 since $-1.89 < -1.28$
(e) Do not reject H_0 since $-1.89 > -2.33$

2. Suppose that we want to test the hypothesis $H_a : \mu \neq \mu_0$ when the sample size is less than 30. In this case use of the t-test requires that the population follow a normal distribution. What method could be used to check this assumption?

(a) draw a normal probability plot and see if the points fall close to a straight line
(b) draw a normal probability plot and see if the points are bell-shaped (like the normal curve)
(c) Find the p-value for the hypothesis test $H_a : \mu \neq \mu_0$ and check to see if it is less than the α value
(d) Find the p-value for the hypothesis test $H_a : \mu \neq \mu_0$ and check to see if it is greater than .10
(e) One-sample t-test for a population mean

3. Suppose that we want to test the hypothesis that the proportion of people in the general population that are left-handed is different from .20 using the 1% significance level, and we find the p-value to be .0587. What is the conclusion of the hypothesis test?

(a) We conclude that the proportion of the population that are left-handed is different from .20, since the p-value is greater than .01.
(b) We **cannot** conclude that the proportion of the population that are left-handed is different from .20, since the p-value is greater than .01.
(c) We conclude that the proportion of the population that are left-handed is equal to .20, since the p-value is greater than .01.
(d) We **cannot** conclude that the proportion of the population that are left-handed is different from .20, since the p-value is less than .10.
(e) We conclude that the proportion of the population that are left-handed is different from .20, since the p-value is greater than .10.

4. As part of a study of the development of the thymus gland, researchers weighed the glands of 40 chick embryos after 14 days of incubation. The average thymus weight was 31.5 mg, with standard deviation 8.7. Test the hypothesis that the average thymus weight after 14 days of incubation is greater than 29 mg, using the 5% significance level.

(a) Do not Reject H_0 since the p-value is equal to .0688, which is greater than .05
(b) Reject H_0 since $1.82 > 1.7709$.
(c) Reject H_0 since the p-value is equal to .0344, which is less than .05
(d) Do not reject H_0 since $1.82 < 1.96$
(e) Do not reject H_0 since $1.82 < 2.1604$

5. In a study of the effect of aluminum intake on the mental development of infants, a group of 11 infants who had been born prematurely were given a special aluminum-depleted intravenous feeding solution. At age 18 months the neurological development of the infant was measured using the Bayley Mental Development Index. The average value was 97.2, with standard deviation 4.3. The average Bayley Mental Development Index in the general population is 100. Test the hypothesis that the average Bayley Mental Development Index for infants on an aluminum-depleted diet is different than for the general population. Use $\alpha = .01$.

(a) Reject H_0 since -2.16 is in the interval from -3.1693 to 3.1693
(b) Do not reject H_0 since -2.16 is in the interval from -3.1693 to 3.1693
(c) Do not reject H_0 since the p-value is equal to $.0154$, which is greater than .01
(d) Do not reject H_0 since the p-value is equal to $.0308$, which is greater than .01
(e) Do not reject H_0 since -2.16 is greater than -2.764.

6. Abuse of substances containing toluene (for example, glue) can produce various neurological symptoms. In an investigation of the mechanism of these toxic effects, researchers measured the concentrations of various chemicals in the brains of rats that had been exposed to a toluene-laden atmosphere, and also in unexposed rats. The concentrations of the brain chemical norepinephrine (NE) in the medulla region of the brain, for six toluene-exposed rats and five control rats is summarized in the Minitab output below.

```
Descriptive Statistics: Toluene, Control

Variable  N   Mean  SE Mean  StDev  Minimum     Q1     Q3  Maximum
Toluene   6  540.8     27.0   66.1    431.0  500.0  581.8    635.0
Control   5  444.2     31.1   69.6    385.0  386.0  518.5    535.0
```

Test the hypothesis that the population variance in the Toluene group is different than for the control group at the 5% significance level.

(a) Do not reject H_0 since 1.33 is less than 7.39
(b) Do not reject H_0 since 1.05 is less than 6.26
(c) Do not reject H_0 since 1.109 is less than 7.39
(d) Do not reject H_0 since 1.109 is less than 9.36
(e) Do not reject H_0 since 1.05 is less than 5.19

7. A pharmaceutical company is testing the effectiveness of a new drug for lowering cholesterol. As part of this trial, they wish to determine whether there is a difference between the effectiveness for women and for men. At $\alpha = .05$, what is the test value?

	Women	Men
Sample size	60	50
Mean effect	6.5	6.45
Sample variance	3.5	3

(a) .1302 **(b)** .4225 **(c)** .1949 **(d)** .0807 **(e)** .1454

8. Consider the data set that is summarized in the partial Minitab Output below. Find the missing value of x (i.e., the value of SST).

```
Source  DF   SS        MS        F         P
C2       ?    ?        ?         16.50     0.000
Error    ?   115.02    3.38
Total   38    x
```

(a) 128.96 **(b)** 282.33 **(c)** 226.56 **(d)** 338.10 **(e)** 142.91

9. Consider the data set that is summarized in the partial Minitab Output below. Find the missing value of x (i.e., the standard deviation for Sample 3).

Source	DF	SS	MS	F	P
C2	2	97.09	48.54	18.02	0.000
Error	34	91.61	2.69		
Total	36	188.70			

Level	N	Mean	StDev
1	10	11.448	1.871
2	10	7.735	1.532
3	?	11.342	x

(a) 1.612 **(b)** 1.734 **(c)** 1.561 **(d)** 1.489 **(e)** 1.835

10. The Minitab output below summarizes the weight gain of lambs on three different diets,

Descriptive Statistics: Diet 1, Diet 2, Diet 3

Variable	N	Mean	SE Mean	StDev	Minimum	Q1	Q3	Maximum
Diet 1	3	11.00	2.52	4.36	8.00	8.00	16.00	16.00
Diet 2	5	15.00	2.21	4.95	9.00	10.00	19.50	21.00
Diet 3	4	12.00	2.48	4.97	6.00	7.00	16.50	17.00

If we were to use ANOVA to test the hypothesis that the mean weight gain is the same for all three diets, what would be the value of $SSTr$?

(a) 36 **(b)** 138.67 **(c)** 107.96 **(d)** 37.33 **(e)** 53.42

11. A pharmaceutical company is testing the effectiveness of a new drug for lowering cholesterol. As part of this trial, they wish to determine whether there is a difference between the effectiveness for women and for men. Suppose that H_0 is not rejected at the 5% level of significance. Which of the following statements is true?

(a) The effect of the drug is different for men than for women.
(b) A Type I error might have occurred.
(c) The probability of a Type II error is 5%.
(d) A Type II error might have occurred.
(e) The effect of the drug is the same for men as for women.

12. Abuse of substances containing toluene (for example, glue) can produce various neurological symptoms. In an investigation of the mechanism of these toxic effects, researchers measured the concentrations of various chemicals in the brains of rats that had been exposed to a toluene-laden atmosphere, and also in unexposed rats. The concentrations of the brain chemical norepinephrine (NE) in the medulla region of the brain, for six toluene-exposed rats and five control rats is summarized in the Minitab output below.

```
---------------------------------------------------------------------------------------------------
Descriptive Statistics: Toluene, Control

Variable  N   Mean  SE Mean  StDev  Minimum     Q1     Q3  Maximum
Toluene   6  540.8     27.0   66.1    431.0  500.0  581.8    635.0
Control   5  444.2     31.1   69.6    385.0  386.0  518.5    535.0
---------------------------------------------------------------------------------------------------
```

Assuming that the population variances are equal, test the hypothesis that the population mean NE concentration for the Toluene group is different than for the control group at the 5% significance level.

(a) Reject H_0 since 2.345 is greater than 2.2622
(b) Reject H_0 since 2.345 is greater than 1.8595
(c) Reject H_0 since 2.357 is greater than 1.8595
(d) Reject H_0 since 2.357 is greater than 2.2622
(e) Reject H_0 since the p-value is equal to .0182, which is less than .05

13. Which of the following is NOT an assumption required for analysis of variance?
(a) The populations must be normally distributed
(b) The population variances must be equal
(c) The samples must be independent
(d) All other factors (other than the treatment variable) affecting the response variable must be constant
(e) No more than $\frac{1}{5}$ of the expected counts can be less than 5

14. Consider the data set that is summarized in the Minitab Output below. Use Tukey's test at the 7% significance level to determine which pairs of means are significantly different.

```
---------------------------------------------------------------------------------------------
Source  DF   SS        MS        F         P
C2      2    103.40    51.70     10.84     0.000
Error   34   162.19    4.77
Total   36   265.59

S = 2.184 R-Sq = 38.93% R-Sq(adj) = 35.34%

Level   N    Mean      StDev
1       9    11.802    2.542
2       14   9.975     2.204
3       14   7.563     1.909

Pooled StDev = 2.184

Tukey 93% Simultaneous Confidence Intervals
All Pairwise Comparisons among Levels of C2

Individual confidence level = 96.94%

C2 = 1 subtracted from:

C2      Lower     Center    Upper
2       -3.969    -1.826    0.316
3       -6.382    -4.239    -2.097

C2 = 2 subtracted from:

C2 Lower     Center    Upper
3  -4.308    -2.413    -0.518
---------------------------------------------------------------------------
```

(a) 1 and 2 only **(b)** 1 and 3, 2 and 3 only **(c)** all of them **(d)** none of them
(e) 1 and 3 only

15. A researcher wants to test whether there is a relationship between education level and smoking status. So the researcher collects some data and produces the following Minitab output. Find the missing value of x (i.e., the missing expected count in row 1 column 1).

```
----------------------------------------------------------------------------------------------------------
--
Tabulated statistics: smokingstatus2, edlevel2

Rows: smokingstatus2   Columns: edlevel2

           H      N     All

D          ?      ?      47
           x      ?       ?

S          ?      5      53
           ?      ?       ?

All        ?     13       ?
           ?      ?       ?

Cell Contents:      Count
                    Expected count

Pearson Chi-Square = ?, DF = 1, P-Value = 0.260
Likelihood Ratio Chi-Square = ?, DF = ?, P-Value = 0.260
----------------------------------------------------------------------------------------------------------
--
```

(a) 39 **(b)** 40.89 **(c)** 6.11 **(d)** 24.91 **(e)** 36.87

16. A sample of 276 healthy adult volunteers were asked about the variety of social networks that they were in (e.g., relationships with parents, close neighbours, workmates, etc.). They were then given nasal drops containing a rhinovirus and were quarantined for five days. Of the 123 subjects who were in five or fewer types of social relationships 57 developed colds. Of 153 who were in at least six types of social relationships 52 developed colds. We want to test whether the probability of getting a cold depends on the number of social relationships a person is in. What method could be used to test this hypothesis?

(a) Contingency table (chi-square test)
(b) Analysis of variance
(c) Two sample t-test, assuming equal variances
(d) Two sample t-test, assuming unequal variances
(e) One-sample z-test for proportions

17. Consider the Minitab output below. Find the missing value of x (i.e., the degrees of freedom).

Tabulated statistics: SMOKING STATUS, GENDER

Rows: SMOKING STATUS Columns: GENDER

	F	M	All
0	25	?	47
	?	?	47.00
	?	?	*
1	?	19	37
	?	?	37.00
	?	?	*
2	7	9	16
	?	?	16.00
	?	?	*
All	?	50	?
	50.00	50.00	100.00
	*	*	*

Cell Contents: Count
Expected count
Contribution to Chi-square

Pearson Chi-Square = ?, DF = x, P-Value = 0.791

(a) 3 **(b)** 6 **(c)** 2 **(d)** 8 **(e)** 4

18. At a midwestern hospital there was a total of 932 births in 20 consecutive weeks. Of these births, 216 occurred on weekends. Do these data reveal more than chance deviation from random timing of births? (Test for goodness of fit, with two categories of births, weekday and weekend. Let $\alpha = .01$)

(a) Yes, because 2603.13 is greater than 16.812
(b) No, because 13.29 is less than 16.812
(c) Yes, because 2603.13 is greater than 6.635
(d) Yes, because 16.812 is greater than 9.210
(e) Yes, because 13.29 is greater than 6.635

Answers (Version 1)**:**

1. d **2.** a **3.** b **4.** c **5.** b **6.** c **7.** e **8.** d **9.** c **10.** a
11. d **12.** d **13.** e **14.** b **15.** b **16.** a **17.** c **18.** e