**1.** In one-way ANOVA, the k population variances are assumed equal.

- True
- False

**2.** In one-way ANOVA, all sample sizes must be the same in order for the test statistic to be valid.

- **a.** True
- **b.** False

**3.** If we reject the null hypothesis in one-way ANOVA, there is evidence to suggest all pairs of population means are unequal.

- **a.** True
- **b.** False

**4.** One-way ANOVA can be used only when there are two means to be compared. For comparing more than two means, we need two-way ANOVA.

- True
- False

**5.** Consider the given data in context of an ANOVA test.

| Group | Observations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 33 | 27 | 27 | 32 | 27 | 31 | 23 | 26 | 34 |
| 2 | 27 | 35 | 32 | 28 | 35 | 39 | 33 | | |
| 3 | 30 | 36 | 33 | 35 | 33 | 28 | | | |

Fill in the blank. (Give your answer as a whole number.)
k = ___

Fill in the blank. (Give your answer as a whole number.)
n = ____

Fill in the blank. (Give your answer as a whole number.)
dfa = ___

Fill in the blank. (Give your answer as a whole number.)
dfe = ___

Fill in the blank. (Give your answer as a whole number.)
dft = ___

**6.** When performing all multiple comparisons, the Tukey method is preferred.

- True
- False

**7.** For Tukey's multiple comparison procedure to be valid, all sample sizes must be the same.

- **a.** True
- **b.** False

**8.** The summary statistics and the confidence intervals are given below for a certain circumstance:

| Sample means | Difference | Confidence interval |
|---|---|---|
| $\bar{x}_1 = 16.09$ | $\mu_1 - \mu_2$ | $(-12.16, -1.07)$ |
| $\bar{x}_2 = 22.71$ | $\mu_1 - \mu_3$ | $(-7.98, 3.11)$ |
| $\bar{x}_3 = 18.53$ | $\mu_1 - \mu_4$ | $(-1.37, 9.72)$ |
| $\bar{x}_4 = 16.33$ | $\mu_2 - \mu_3$ | $(-5.78, 5.31)$ |
| | $\mu_2 - \mu_4$ | $(0.83, 11.92)$ |
| | $\mu_3 - \mu_4$ | $(-3.34, 7.75)$ |

Identify the graph, indicating pairs of means that are and are not significantly different, corresponding to the given data.

The choices are:

A.

| $\bar{x}_{1.}$ | $\bar{x}_{4.}$ | $\bar{x}_{3.}$ | $\bar{x}_{2.}$ |
|---|---|---|---|
| 16.09 | 16.33 | 18.53 | 22.71 |

B.

| $\bar{x}_{1.}$ | $\bar{x}_{4.}$ | $\bar{x}_{3.}$ | $\bar{x}_{2.}$ |
|---|---|---|---|
| 16.09 | 16.33 | 18.53 | 22.71 |

C.

| $\bar{x}_{1.}$ | $\bar{x}_{4.}$ | $\bar{x}_{3.}$ | $\bar{x}_{2.}$ |
|---|---|---|---|
| 16.09 | 16.33 | 18.53 | 22.71 |

D.

| $\bar{x}_{1.}$ | $\bar{x}_{4.}$ | $\bar{x}_{3.}$ | $\bar{x}_{2.}$ |
|---|---|---|---|
| 16.09 | 16.33 | 18.53 | 22.71 |

- **a.** A.
- **b.** B.
- **c.** C.
- **d.** D.

**9.** The results from a multiple comparison procedure are shown graphically below. Use the illustration to identify all pairs of population means that are statistically the same.

| | $\bar{x}_{1.}$ | $\bar{x}_{2.}$ | $\bar{x}_{3.}$ | $\bar{x}_{4.}$ |
|---|---|---|---|---|
| Sample mean | 29.98 | 32.59 | 32.62 | 37.25 |

- ☐ **a.** 1 and 2
- ☐ **b.** 1 and 3
- ☐ **c.** 1 and 4
- ☐ **d.** 2 and 3
- ☐ **e.** 2 and 4
- ☐ **f.** 3 and 4

**10.** A study was conducted to compare the population mean age of women at the time of their first marriage. Independent random samples of size 11 were obtained from weddings in three different years. The resulting ANOVA test was significant at the alpha = 0.003 level. The sample means are given. Consider MSE = 17.68.

| Year | 1985 | 2003 | 2008 |
|---|---|---|---|
| $\bar{x}$ | 23.3 | 25.3 | 27.9 |

Fill in the blanks. (Give your answers to two decimal places.)

1. The Tukey 95% confidence interval for the difference $\mu_1 - \mu_2$ is ( (Answer 1) , (Answer 2) ).

2. The Tukey 95% confidence interval for the difference $\mu_1 - \mu_3$ is ( (Answer 3) , (Answer 4) ).

3. The Tukey 95% confidence interval for the difference $\mu_2 - \mu_3$ is ( (Answer 5) , (Answer 6) ).

---

Which of the pairs are significantly different?
1985 and 2003?

- Yes
- No

2003 and 2008?

- Yes
- No

1995 and 2008?

- Yes
- No