Chapter (12) practice questions

Q1 The following table summarizes the results of the analysis of variance, fill the missing values:

Source	Sum of squares	d.f	Mean square	F
Between	459.18	2	229.59	5.05
Within	_____	15	_____	
Total	1141.68	_____		

Q2 The following set of data values was obtained from a study of people's perceptions on whether the color of a person's clothing is related to how intelligent the person looks. The subjects rated the person's intelligence on a scale of 1 to 10. Group 1 subjects were randomly shown people with clothing in shades of blue and gray. Group 2 subjects were randomly shown people with clothing in shades of brown and yellow. Group 3 subjects were randomly shown people with clothing in shades of pink and orange. The results follow. Using 5% significance level.

Group 1	Group 2	Group 3
8 7 7 7 8 8 6	7 8 7 7 5 8 5	4 9 6 7 9 8 5
$\bar{X}_1 = 7.29$ $S_1^2 = 0.57$	$\bar{X}_2 = 6.71$ $S_2^2 = 1.57$	$\bar{X}_3 = 6.86$ $S_3^2 = 3.81$

A) Use ANOVA to test for any significant differences between the means.
B) What is the purpose of this study?

Q3 True or False:

1) In the analysis of variance, the null hypothesis should be rejected only when there is a significant difference between all pairs of means.
2) The F test does not use the concept of degrees of freedom.
3) When the F test value is close to 1, the null hypothesis should be rejected.
4) We wish to have small values of F test when performing the analysis of variance.
5) The F test can also be used to test the equality of two means. But since it is equivalent to the t test in this case, the t test is usually used instead of the F test when there are only two means.
6) In the analysis of variance, the populations from which the samples were obtained must be normally or approximately normally distributed.
7) In the analysis of variance, the variances of the populations must be equal.
8) The between-group variance measures the variability within each group, regardless of the differences in group means.
9) The within-group variance measures the variability within each group, regardless of the differences in group means.
10) When three or more means are compared, you use the Z technique.
11) The sample sizes need not be equal.

Q4 choose the correct answer:

1) Analysis of variance uses the _____ test:
   a) Z b) F c) t d) χ^2
2) The null hypothesis in ANOVA is that all the means are:
   a) Equal b) Variable c) Unequal d) None
3) F test has degree of freedom:
   a) (K-1, N-1) b) (N-k,k-1) c) (k-1, N-k) d) (N, K)
4) For a test of the difference among three or more means, the following hypotheses should be used:

a) $H_0 : \mu_1 = \mu_2 = \cdots = \mu_k$ H_1 : At least one mean is different from the others.
b) $H_0 : \mu_1 \neq \mu_2 \neq \cdots \neq \mu_k$ H_1 : At least one mean is different from the others.
c) $H_0 : \mu_1 \neq \mu_2 = \cdots = \mu_k$ H_1 : At least one mean is different from the others.
d) H_0 : At least one mean is different from the others. $H_1 : \mu_1 = \mu_2 = \cdots = \mu_k$

Q5 complete the following ANOVA table, and at 10% significance level, would you reject H0?

(hint: $F_{0.90}(2,942) = 2.31$)

Source	Sum of squares	d.f	Mean square	F
Between	2403.5	2	_____	
Within	193237.4	942	_____	
Total	195640.8	944		

Q6 Researchers compared protein intake among three groups of postmenopausal women: (1) women eating a standard American diet (STD), (2) women eating a lactoovo-vegetarian diet (LAC), and (3) women eating a strict vegetarian diet (VEG). Perform a statistical procedure to compare the means of the three groups.

Group	Mean	*sd*	*n*
STD	75	9	10
LAC	57	13	10
VEG	47	17	6

chapter (12) solutions:-

Q1

1. $F = \frac{MSB}{MSW} \Rightarrow 5.05 = \frac{229.59}{MSW} \rightarrow MSW = 45.468.$

2. $d.f_{(total)} = 2 + 15 = 17.$

3. $SST = SSB + SSW$
   $1141.68 = 439.18 + SSW \quad \therefore SSW = 682.5.$

Q2.

A) $SSB = \sum n_i . \bar{x}_i^2 - \frac{(\sum n_i . \bar{x}_i)^2}{n}$

$= 7(7.29)^2 + 7(6.71)^2 + 7(6.86)^2 - \left[\frac{(7(7.29) + 7(6.71) + 7(6.86))^2}{21}\right]$

$= 1016.546 - 1015.326$

$\therefore SSB = 1.22 \rightarrow MSB = \frac{SSB}{K-1} = \frac{1.22}{3-1} = 0.61$

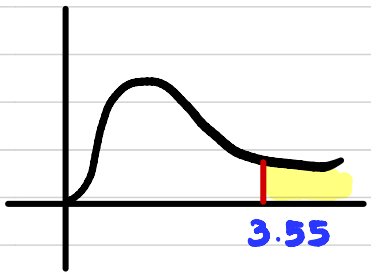
$SSW = \sum (n_i - 1)S_i^2 = 6(0.57) + 6(1.57) + 6(3.81)$

$\therefore SSW = 35.7 \rightarrow MSW = \frac{SSW}{N-K} = \frac{35.7}{21-3} = 1.983$

$F = \frac{MSB}{MSW} = \frac{0.61}{1.983} = 0.308.$

$d.f = (2, 18) \quad$ with $\alpha = 0.05$

$\therefore$ we don't rej H_0.



B) To determine if the color if a person's clothing is related to people's perceptions of how intelligent the person looks.

Q3 1) False, at least one.

2) False, It has two d.f's.

3) False, smaller F-test indicate that we tend to support H_0.

4) True.

5) True

6) True.

7) True.

8) False, within group variability.

9) True

10) False, ANOVA.

11) True.

Q4 1) b 2) a 3) c 4) a

Q5 $MSB = \frac{SSB}{K-1} = \frac{2403.5}{2} = 1201.75$

$MSW = \frac{SSW}{N-K} = \frac{193237.4}{942} = 205.14$

$F = \frac{MSB}{MSW} = \frac{1201.75}{205.14} = 5.86.$

∴ we rej H_0.

Q6

$$SSB = \sum n_i \cdot \bar{x}_i^2 - \frac{(\sum n_i \cdot \bar{x}_i)^2}{n}$$

$$= 10(75)^2 + 10(57)^2 + 6(47)^2 - \left[\frac{(10(75) + 10(57) + 6(47))^2}{26}\right]$$

$$= 101,994 - 98,707.85$$

$$\therefore SSB = 3286.15 \rightarrow MSB = \frac{SSB}{K-1} = \frac{3286.15}{3-1} = 1643.08$$

$$SSW = \sum (n_i - 1) S_i^2 = 9(9)^2 + 9(13)^2 + 5(17)^2$$

$$\therefore SSW = 3695 \rightarrow MSW = \frac{SSW}{N-K} = \frac{3695}{26-3} = 160.65$$

$$F = \frac{MSB}{MSW} = \frac{1643.08}{160.65} = 10.228.$$