MS Module 11 Single-Factor ANOVA practice exam questions

(The attached PDF file has better formatting.)

[The practice problems in the 24 modules explain the statistical procedures; the practice exam questions in this thread shows what you will be asked on the final exam.]

A experiment has three groups and four observations in each group.

obsv →	1	2	3	4
group 1	14	22	16	14
group 2	12	15	14	25
group 3	7	17	24	32

The groups are normally distributed with the same variance.

The null hypothesis is that the means of the groups are the same: H_0: $\mu_1 = \mu_2 = \mu_3$

Question 10.1: Square of the sum of the observations

What is the square of the sum of all the observations, or $x_{..2}$?

Answer 10.1: $(14 + 22 + 16 + 14 + 12 + 15 + 14 + 25 + 7 + 17 + 24 + 32)^2 = 44{,}944$

Question 10.2: Sum of the squares of the observations

What is the sum of the squares of all the observations, or $\sum_i \sum_j x_{ij}^2$?

Answer 10.2: $14^2 + 22^2 + 16^2 + 14^2 + 12^2 + 15^2 + 14^2 + 25^2 + 7^2 + 17^2 + 24^2 + 32^2 = 4{,}260$

Question 10.3: Total sum of squares

What is SST, the total sum of squares?

Answer 10.3: 4,260 – 44,944 / 12 = 514.67

(the total sum of squares = the sum of the squares of all the observations – the square of the sum of all the observations / the number of observations)

Question 10.4: Sums of squares of group totals

What is the sum of squares of the group totals?

Answer 10.4: $(14 + 22 + 16 + 14)^2 + (12 + 15 + 14 + 25)^2 + (7 + 17 + 24 + 32)^2 = 15{,}112$

Question 10.5: Treatment sums of squares

What is SSTr, the treatment sum of squares?

Answer 10.5: 15,112 / 4 – 44,944 / 12 = 32.67

(treatment sums of squares = the sum of squares of the group totals / the number of observations per group – the square of the sum of all the observations / the total number of observations)

Question 10.6: Error sum of squares

What is SSE, the error sum of squares?

Answer 10.6: 514.67 – 32.67 = 482.00

(error sum of squares = total sum of squares – treatment sums of squares)

Question 10.7: Total degrees of freedom

What are the total degrees of freedom?

Answer 10.7: 12 – 1 = 11

(total degrees of freedom = number of observations – 1)

Question 10.8: Degrees of freedom for the groups

What are the degrees of freedom for the groups?

Answer 10.8: 3 – 1 = 2

(degrees of freedom for the groups = number of groups – 1)

Question 10.9: Degrees of freedom for the error sum of squares

What are the degrees of freedom for the error sum of squares?

Answer 10.9: 11 – 2 = 9

(degrees of freedom for the error sum of squares = total degrees of freedom – degrees of freedom for the groups)

Question 10.10: Mean squared deviation for the groups

What is MSTr, the mean squared deviation for the groups?

Answer 10.10: 32.667 / 2 = 16.33

(mean squared deviation for the groups = treatment sums of squares / degrees of freedom for the groups)

Question 10.11: Mean squared error

What is MSE, the mean squared error?

Answer 10.11: 482 / 9 = 53.556

(mean squared error = error sum of squares / degrees of freedom for the error sum of squares)

Question 10.12: *F* value

What is the *F* value for testing the null hypothesis?

Answer 10.12: 16.333 / 53.556 = 0.305

(*F* value = treatment mean square / mean squared error)