MS Module 11 Single-Factor ANOVA Tukey's procedure practice exam questions

(The attached PDF file has better formatting.)

Five groups, each with 7 observations, have sample means of

$$\overline{x}_1 = 3.2,\ \overline{x}_2 = 3.1,\ \overline{x}_3 = 3.5,\ \overline{x}_4 = 3.9,\ \overline{x}_5 = 3.7$$

The total sum of squares (SST) is 20, and the treatment sum of squares (SSTr) is 11.

The groups have normal distributions with equal variances. We test the null hypothesis $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$ at a 5% confidence level. If we reject the null hypothesis, we test which groups means differ significantly.

Question 11.1: Error sum of squares

What is the error sum of squares SSE?

Answer 11.1: 20 – 11 = 9

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

Question 11.2: Treatment mean square

What is the mean square for the groups (treatment mean square)?

Answer 11.2: 11 / (5 – 1) = 2.75

(treatment mean square = treatment sums of squares / (number of groups – 1))

Question 11.3: Mean squared error

What is the mean squared error MSE?

Answer 11.3: 9 / (5 × 7 – 5) = 0.30

(degrees of freedom for mean squared error = (number of groups – 1) × observations per group; mean squared error = error sum of squares / its degrees of freedom)

Question 11.4: *F* value

What is the *F* value to test the null hypothesis?

Answer 11.4: 2.75 / 0.30 = 9.167

Question 11.5: Critical *F* value

What is the critical *F* value for α = 5%?

Answer 11.5: 2.69

(Table look-up: α = 5%; degrees of freedom = 4, 30)

Question 11.6: Critical *Q* value

What is the critical *Q* value for α = 5%?

Answer 11.6: 4.10

(Table look-up: α = 5%; degrees of freedom = 5, 30)

Question 11.7: *W* (the width of the difference) for Tukey's honestly statistical difference?

What is *w* (the width of the difference) for Tukey's honestly statistical difference?

Answer 11.7: $4.1 \times (0.30 / 7)^{0.5} = 0.849$

(Tukey's *W* = critical Q value × (mean squared error / observations per group)$^{0.5}$)