PSYCHOLOGY 300B (S01)

Examination #2: Answers

1. Null hyp.: All three population means are equal or  \( H_0: \mu_1 = \mu_2 = \mu_3 \) (1 pt)
   Alternative hyp.: The three populations means are not all equal to one another (1 pt)
   [there is no simple symbolic expression of the alternative hypothesis]

2. (b) \( SS_{\text{group}} \) (e) \( MS_{\text{group}} \) (f) \( SS_{\text{total}} \) (h) \( F \) (4 pts)
   [variability between group means will increase when the null hypothesis is false, and this will also cause total variability and \( F \) to increase]

3. The populations of scores have equal variance (1 pt)
   [if this assumption is valid, then the measure of variability within each group provides an estimate of the same quantity, \( \sigma^2 \)]

4. (a) \( F = 4.20 \) (1 pt) \([F = 147/35 = 4.20]\]
   (b) 3.15, significant (1 pt) [the \( F \) ratio has (2, 60) df]
   (c) .36 (1 pt) \([\delta = .5\sqrt{(21/2)} = 1.62]\]
   (d) No. The study did not have adequate power to detect an effect of \( d = .5 \). (2 pts) [a real effect of .5 could exist, but this test would have very little chance of detecting it]

5. (a) A vs B, A vs D, and B vs C (1 pt) [any comparison with a significance value less than \( \alpha (.05) \) is significant]
   (b) A vs B (1 pt) [with 6 comparisons and familywise \( \alpha = .05 \), each comparison must be tested with pairwise \( \alpha = .05/6 = .0083; \) only A vs B is significant by that criterion]

6. (a) Main effect of B (2 pts) [means for B are \((23+20)/2 = 21.5\) and \((17+14)/2 = 15.5\), which is a 6-point difference; means for A are \((23+17)/2 = 20\) and \((20+14)/2 = 17\), which is a 3-point difference (not significant); the effect of B is 6 points at A1 and at A2, so there is no interaction]

[other patterns are possible but the line for B2 should show a clear slope so that the effect of B at A1 is the opposite of the effect of B at A2, and so that the overall main effect of B is not significant]
(c) B1 B2 B3 (2 pts) [other patterns are possible; notice that the means for A1 (7.3) and A2 (8.0) are not significantly different and neither are the means for the B main effect (7,9,7); the effect of A at B1 (–2) is significantly different from the effect of A at B2 (+2) -- a difference between differences of 4 points]

7. (a) \( t = 3.30, \text{ significant} \) (2 pts) [relevant means are 11.5 vs. 8.5; \( t = (11.5-8.5)/\sqrt{[(20.5/50)+(20.5/50)]} = 3/0.91 = 3.30 \); \( t_{\text{critical}}(100) = \pm 1.984 \)]

(b) \( F_{\text{Learning@Young}} = 1.22, \text{ not significant}; F_{\text{Learning@Old}} = 8.54, \text{ significant} \) (2 pts)
\[
SS_{\text{Learning@Young}} = 25[(12-12)^2+(11-12)^2+(13-12)^2] = 50; \quad MS_{\text{Learning@Young}} = 50/2 = 25; \\
F_{\text{Learning@Young}} = 25/20.5 = 1.22; \\
SS_{\text{Learning@Older}} = 25[(11-8)^2+(6-8)^2+(7-8)^2] = 350; \quad MS_{\text{Learning@Older}} = 350/2 = 175; \\
F_{\text{Learning@Older}} = 175/20.5 = 8.54]

(c) Learning among older adults depends on the information source, but there is no evidence that this effect holds for younger adults. (1 pt)

8. **No** (1 pt) [Even though factor A had no main effect, it participates in an interaction, which means that A does influence the dependent variable, but its effect depends on the level of factor B. Given that there is an interaction, but no main effect of A, it is likely that A has opposite effects on the dependent variable, depending on the level of factor B.]

9. (c) \( MS_{\text{error}} \) (1 pt) [when an effect is not significant, its \( MS \) value will generally reflect only raw score variance, rather than any difference between population means, so the \( MS \) for the effect will be similar to \( MS_{\text{error}} \)]