Examination 1: Answers

1. (a) **design 1** (1 pt) [Dividing the subjects into two groups based on self-report means that the groups represent naturally occurring populations with high versus low frequency of exposure to violent media. Design 2 used a single sample of subjects from a single population, then subjects were assigned to treatment conditions.]

   (b) **design 2** (1 pt) [Only in design 2 were subjects randomly assigned to conditions. In design 1, differences could be due to an extraneous factor related both to exposure to depictions of violence in media and to tendency toward violent behavior]

2. (a) **a directional H₁ is justified** (1 pt) [the researcher expects training to improve skills]

   (b) **negative** (1 pt) [higher scores would occur in the control group which is coded as 0, whereas lower scores would occur in the training group which is coded as 1, so low skill scores would be associated with high group scores and vice versa]

   (c) **Yes** (1 pt) [subjects were randomly assigned to conditions, so condition differences can be identified as the cause of differences in skill scores; this is so even though differences in skill scores were detected using a correlation coefficient]

3. (a) **-1.39 or 1.39** (2 pts)

   \[ s_{M_1-M_2} = \sqrt{\frac{49}{18} + \frac{9}{18}} = 1.795; t = \frac{19.8 - 22.3}{1.795} = -1.39 \]

   [the sign of the t ratio is arbitrary and depends on the order of subtraction of the means]

   (b) **Variance estimates from the two samples cannot be pooled because they are too different from one another** (1 pt) [the two variances are 49 and 9, which differ by more than a ratio of 4 to 1]

   (c) **t_{critical}(17) = 2.110** (1 pt) [variances were not pooled because the assumption of equal variance was not supported, so df is determined by the smaller of the two samples]

   (d) **H₀ is not rejected** (0.5 pt) **There is no evidence in this study that the treatment has an effect on depression scores** (0.5 pt) [we cannot say that the treatment has no effect or that H₀ is true because this study may not have had enough power to detect a small effect]

4. (a) and (c) (2 pts) [if raw score distributions are normal or if sample sizes are at least 30, then distributions of sample means will be normal and the distribution of differences between means will be normal]

5. **distribution of sample means** (2 pts) [the variance of the distribution of sample means equals the variance of the population of raw scores, divided by the square root of the sample size, so the sample mean distribution necessarily has
smaller variance than the distribution of raw scores (remember, sample size here is 20); the variance of the distribution of differences between means equals the sum of the variance of the distribution of sample means for each population, so it is necessarily larger than either of those two variances]

6. .71 (3 pts) [critical $z = \pm 1.96$; $\sigma_M = 2.0$; critical $M = 50 \pm 2.0(1.96) = 46.08, 53.92$; so the regions of rejection are sample means that are less than or equal to 46.08 or sample means that are greater than or equal to 53.92; under $H_1$, $z$ for a mean of 46.08 is $(46.08 - 55)/2.0 = -4.46$, and $z$ for a mean of 53.92 is $(53.92 - 55)/2.0 = -0.54$; for $z = -4.46$, area in the smaller portion is virtually zero; for $z = -0.54$, area in the larger portion = .7054; power = .7054 or .71]

7. (a) 0.5 (1 pt) [$d = (23.4 - 20)/6.8 = 0.5$]
   (b) 26 (1 pt) [$\delta = .2\sqrt{25} = 1.0$]

8. (a) 784 (1 pt) [for power = .80 and a nondirectional test with $\alpha = .05$, $\delta = 2.80$; $n = 2(2.80/.2)^2 = 392$ per group]
   (b) .68 (1 pt) [$\delta = .2\sqrt{(392/2)} = .2(14) = 2.8$; from the power table, with $\alpha = .02$ for a two-tailed test (this corresponds to $\alpha = .01$ for a one-tailed test), power is .68]

9. This study had plenty of power (.87) to detect a large effect size, so it is unlikely that the population means differ by as much as .8 standard deviation. (2 pts)
   [$\delta = .8\sqrt{\frac{20}{2}} = 3.10$] From the power table, with $\alpha = .05$ and a two-tailed test, power is .87.