Test 13A

1. (a) 2. (b) 3. (a) 4. (c) 5. (c) 6. (d) 7. (b) 8. (a) ***Step 1:*** Let population 1 be all cultures of bacteria which might be treated with nitrite and let population 2 be all cultures of bacteria which go untreated. We want to test a claim about the mean amino acid uptakes in these two populations. H_0: $\mu_1 = \mu_2$ (or $\mu_1 - \mu_2 = 0$) vs. H_a: $\mu_1 < \mu_2$ (or $\mu_1 - \mu_2 < 0$). ***Step 2:*** This is a two-sample t test. SRS—The cultures were randomly allocated to the two treatment groups. Normality—the large sample sizes should assure the approximate Normality of the sampling distribution of $\bar{x}_1 - \bar{x}_2$. Independence—the random assignment should help ensure two groups of 30 independent measurements. ***Step 3:*** $t = \dfrac{7880-8112}{\sqrt{\dfrac{1115^2}{30}+\dfrac{1250^2}{30}}} = -0.759$. Using the table, df = 29 gives $0.2 < P\text{-value} < 0.25$. The TI calculator gives df = 57.25855, and P-value = 0.2256. ***Step 4:*** There is insufficient evidence to reject H_0. We cannot conclude that nitrites decrease amino acid uptake. (b) Using df = 29, the critical value $t^* = 2.045$ and the confidence interval for $\mu_1 - \mu_2$ is

$(7880-8112) \pm 2.045\sqrt{(1115^2/30)+(1250^2/30)} = (-857.396, 393.396)$. TI calculator gives $(-844.3, 380.3)$ with df = 57.26. We can conclude that the true effect of the nitrites is anything between decreasing amino acid uptake by a mean of 844.3 to increasing the uptake by a mean of 380.3.

9. (a) ***Step 1:*** Population 1 is all smokers who are trying to quit smoking with a nicotine patch. Population 2 is all smokers who are trying to quit smoking with a patch and the drug bupropion. We want to test the hypotheses $H_0: p_1 = p_2$ vs. $H_a: p_1 < p_2$, where p_1 and p_2 are the proportions of these two populations who have stopped smoking after a year. ***Step 2:*** SRS—We must be willing to treat each of the two samples as an SRS from the respective population of interest. Independence—We need at least 10(244) = 2440 in population 1, and at least 10(245) = 2450 in population 2. These seem plausible. Normality—The pooled proportion of those who have stopped smoking is $\hat{p} = (40+87)/(244+245) = 0.2597$. So $n_1\hat{p} = 63.4$, $n_1(1-\hat{p}) = 180.6$, $n_2\hat{p} = 63.6$, $n_2(1-\hat{p}) = 181.4$. All are at least 5. ***Step 3:*** The test statistic is $z = (40/244 - 87/245)/\sqrt{0.2597(1-0.2597)(1/244+1/245)} = -4.82$ and the P-value is virtually 0. ***Step 4:*** There is very strong evidence to conclude that adding bupropion increases the success rate. (b) The correct Normality condition for the confidence interval: The counts for all the successes and failures are all at least 5. A 99% CI is (40/244 – 87/245) ± $2.576\sqrt{[0.1639(1-0.1639)/244]+[0.3551(1-0.3551)/245]} = (-0.29, -0.091)$. We are 99% confident that the proportion of smokers who quit smoking after a year is between 2.9% and 9.1% higher if they add the drug bupropion in addition to the using just the nicotine patch.

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