Math 145 Test 3A Name: Row:

Express your answers neatly and show how to do each problem for credit. No work = no credit.

1. Determine whether the study uses independent samples (**IS**) or matched pairs (**MP**) (circle one for each):

   - (**IS** | **MP**) Two computing algorithms are compared in terms of the CPU times requried to do the same six test problems.
   - (**IS** | **MP**) A survey is conducted of teens from inner city schools and suburban schools to compare the proportion who have tried drugs.
   - (**IS** | **MP**) A psychologist measures the response times of subjects under two stimuli; each subject is observed under both of the stimuli in a random order.
   - (**IS** | **MP**) An agronomist compares the yields of two varieties of soybean by planting each variety in 10 separate plots of land (a total of 20 plots).

2. A person's muscle mass is expected to decrease with age. To explore this relationship, a nutritionist randomly selected 30 subjects between the ages of 40 and 80 and recorded the age and muscle mass (in kg) for each. The fitted regression equation was $\hat{y} = 157.45 - 1.22x$. The standard error of the slope was reported to be 0.133 and the linear correlation coefficient was -0.707.

   (a) Give brief statistical evidence to show that there is a statistically significant linear correltation between age and muscle mass.

   (b) Give the coefficent of determination and interpret what is means for this model *in context.*

   (c) **Construct** a 95% confidence interval for the population slope and **interpret** its meaning *in the context of this problem.*

   (d) Given that $SE_{\hat{\mu}} = 1.68$ and $SE_{\hat{y}} = 9.06$, construct a 90% interval estimate of the muscle mass of *an individual* person who is 63 years of age. **Interpret** your interval.

3. Suppose we suspected an unusual distribution of blood groups in patients undergoing one type of surgical procedure. We know that the expected distribution for the population served by the hospital which performs this surgery is 44% group O, 45% group A, 8% group B and 3% group AB. A random sample of 187 patients undergoing this surgical procedure have the following distribution of blood types:

Blood Group	O	A	B	AB
Count	67	83	29	8

Is there statistically significant evidence ($\alpha = .05$) that patients undergoing this procedure have a different distribution of blood types than the general population served by this hospital?

- H_0 :
- H_1 :
- **Test Statistic:** The correct value of the test statistic is $\chi^2 = 57.27$. Fill in the first expected cell count and show how to *start* computing the test statistic.
- P**-value:**
- **Reject** H_0 | **Fail to reject** H_0
- **Give a practical conclusion:**

4. A manufacturer of platinum tipped sparkplugs believes that they last longer than conventional sparkplugs. To show this, one platinum plug and one convential plug were installed in each of six two-cylinder engines. The effective life in hours was measured for each plug:

Engine	1	2	3	4	5	6
Platinum Plug	640	570	530	410	600	580
Conventional Plug	470	370	460	490	380	410

$\bar{x}_P = 538.3, \quad s_P = 78.8, \quad \bar{x}_C = 430.0, \quad s_C = 50.2, \quad d = P - C, \quad \bar{x}_d = 108.3, \quad s_d = 103.0$

(a) Do the platinum plugs last longer on average? Conduct a complete hypothesis test at the 10% level of significance.

- H_0 : $\qquad\qquad\qquad\qquad$ H_1 :
- **Test Statistic:**
- P**-value:**
- **Reject** H_0 | **Fail to reject** H_0
- **Give a practical conclusion:**

(b) In the conclusions to the test above, what type of error (I or II) might you have just made?

(c) If the null hypothesis were true here, then what was the probability of a type I error?

5. A manufacturer of television sets is interested in the effect of the tube conductivity of four different types of coating for color picture tubes. Conductivity is obtained for independent, random samples of tubes using each coating type. Each sample is of size 4.

(a) If the sum of squares for groups is 843.97 and the sum of squares for errors is 148.93, complete the ANOVA table below:

Source	df	SS	MS	F
Groups				
Error				
Total				

(b) Conduct a complete ANOVA test to determine if the type of coating used has an effect on conductivity. Use $\alpha = 0.05$.

- H_0 :
- H_1 :
- **Test Statistic:** (from ANOVA table)
- **critcal value:**
- **Reject H_0 | Fail to reject H_0**
- **Give a practical conclusion:**

(c) Bonferroni 94% comparisons have been constructed from the data. Construct and fill in the missing interval and interpret your findings (which population means are larger).

Coating	Sample Mean Conductivity
A	145.00
B	145.25
C	132.25
D	129.25

Comparison	94% CI's
$\mu_A - \mu_B$	(-6.92,6.42)
$\mu_A - \mu_C$	(6.08,12.75)
$\mu_A - \mu_D$	(9.08,22.42)
$\mu_B - \mu_C$	(6.33,19.67)
$\mu_B - \mu_D$	
$\mu_C - \mu_D$	(-3.67,9.67)

6. Little Billy is asked to consult an agricultural resarch project. Researchers wish to determine if a kelp extract protects tomato plants from frost damage. Two similar plots are planted with the same variety of tomato plants. Plants in plot 1 are treated with the kelp extract and plants in plot 2 are not. After the first frost in autumn, 23 of 92 tomato plants in plot 1 exhibit damage ($\hat{p}_1 = .2500$). In plot 2, 36 of 104 tomato plants exhibit damage ($\hat{p}_2 = .3462$).

   (a) Little Billy concludes that since the sample proportion of plants damaged in the kelp-treated plot is lower than in the plot that is not kelp-treated ($\hat{p}_1 < \hat{p}_2$) the kelp treatment must be effective at reducing frost damage. What is wrong with Little Billy's argument?

   (b) Give a solid inferential statistics argument that either supports or refutes Little Billy's conclusion (at 95% or .05 if needed).