Prince Sultan University

Department of Mathematical Sciences

STAT 271 – Final Examination

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Time allowed: 150 minutes Maximum points: 80 points

1. (7 points) A random sample of $n = 500$ observations from a binomial population produced $x = 140$ successes.
   (a) Find a point estimate for p, and find the margine of error for your estimator.
   (b) Find an 98% confidence interval for p. Interpret this interval.

2. (4 point) If it is assumed that the heights of men are normally distributed with a standard deviation of 2.5 inches, how large a sample should be taken to be 85% sure that the sample mean does not differ from the population mean by more than 0.5 in absolute value?

3. (4 points) Suppose that you have a random sample of size 50 from a population with unknown mean and variance 1225. Calculate the width of a 90% confidence interval for μ.

4. (5 points) The average hourly wage for public school cafeteria workers was given as \$10.33. If $n = 40$ randomly selected public school cafeteria workers within one school district are found to have an average hourly wage of \$9.75 with a standard deviation \$1.65, would this information contradict the reported average of \$10.33? (Use the p-value approach with $\alpha = 0.02$)

5. (8 points) The stae of California is working very hard to make sure that all elementary-aged students whose native language is not English become proficient in English by the sixth grade. Their progress in monitored each year using the California English Language Development Test. The results for two school districts in southern California for a recent school year are shown below.

District	Riverside	Palm Springs
Number of students Tested	6124	5512
Percentage Fluent	40	37

   (a) Does this data provide sufficient statistical evidence to indicate that the percentage of students who are fluent in English differs for these two districts? Test using $\alpha = 0.01$?
   (b) Construct a 99% confidence interval for the difference in the percentage of students who are fluent in English in the two districts. Do you arrive at the same conclusion as in part (a).

6. (13 points) An experiment was conducted to examine the effect of age on heart rate when a person is subjected to a specific amount of exercise. Ten male subjects were randomly selected from four age groups: 10-19, 20-39, 40-59, and 60-69. Each subjct walked on a treadmill at a fixed grade for a period of 12 minutes, and the increase in heart rate, the difference before and after exercise, was recorded (in beats per minute):

	10 – 19	20 - 39	40 - 59	60 – 69
	29	24	37	28
	33	27	25	29
	26	33	22	34
	27	31	33	36
	39	21	28	21
	35	28	26	20
	33	24	30	25
	29	34	34	24
	36	21	27	33
	22	32	33	32
Total	309	275	295	282

Given that $\sum x_{ij}^2 = 34701$,

(a) Do the data provide sufficient evidence to indicate a difference in mean increase in heart rate among the four age groups? Find the *p*-value of the test.

(b) Find a 90% confidence interval for the difference in mean increase in heart rate between age groups 10-19 and 60-69. Is there a significant difference between the means of the two groups? Why?

7. (13 points) To test a subject's ability to estimate sizes, he was shown 10 different objects and asked to estimate their length or diameter. The object was then measured, and the results were recorded in the table below.

Object	Estimated (inches)	Actual (inches)
Pencil	7	6
Dinner plate	9.5	10.25
Book 1	7.5	6.75
Cell phone	4	4.25
Photograph	14.5	15.75
Toy	3.75	5
Belt	42	41.5
Clothespin	2.75	3.75
Book 2	10	9.25
Calculator	3.5	4.75

(a) Find the least-squares regression line for predicting the actual measurement as a function of the estimated measurement.

(b) Construct the ANOVA table for the linear regression.

(c) Do the data present sufficient evidence to indicate that the estimated and actual measurements are linearly related? Test at the 5% level of significance using both *F* and *t* tests. Do the two tests lead to the same conclusion? (Use the critival value appr.)

8. (4 points) An experimenter was interested in determining the mean thickness of the cortex of the sea urchin egg. The thickness was measured for 10 sea urchin eggs. These measurements were obtained:

4.5 6.1 3.2 3.9 4.7 5.2 2.6 3.7 4.6 4.1

Estimate the mean thickness of the cortex using an 98% confidence interval.

9. (6 points) Suppose that you fit the model $E(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$ to 21 data points and found *F* equal to 4.05.
(a) Do the data provide sufficient evidence to indicate that the model contributes information for the prediction of *y*? Test using a 1% level of significance.
(b) Use the value of *F* to calculate the coefficient of determination.

10. (8 points) As an alternative to flextime, many companies allow employees to do some of their work at home. Individuals in a random sample of 300 workers were classified according to salary and number of workdays per week spent at home.

	Workdays at Home per Week			
Salary	Less than one	At least one, but not all	All at Home	Total
Under $25000	38 *(36.27)*	16 *(21.08)*	14 *(10.65)*	68
$25000 - $49999	54 *(49.07)*	26 *(28.52)*	12 *(14.41)*	92
$50000 - $74999	35 *(35.2)*	22 *(20.46)*	9 *(10.34)*	66
Above $75000	33 *(39.47)*	29 *(22.94)*	12 *(11.59)*	74
Total	160	93	47	300

Given all the 12 *estimated expected cell counts,* $\hat{E}_{ij}$, (inside brackets),

(a) Do the data present sufficient evidence to indicate that salary is dependent on the number of workdays spent at home? Test using $\alpha = 0.05$.
(b) Approximate the *p*-value for this test of hypothesis. Does the *p*-value confirm your conclusions from part (a)?

11. (8 points) To investigate the effect of sleep on basal metabolism, six college students who averaged seven or more hours of sleep a night (Group *A*), and six students who averaged less than seven hours of sleep a night (Group *B*), were examined and their basal metabolism recorded as shown below:

Group *A*	36	34	34	38	33	37
Group *B*	30	36	31	29	32	34

Use the Wilcoxon rank sum procedure to determine whether the metabolism measurements for Group *A* are significantly higher than those of Group *B*.
Use $\alpha = 0.05$.

Best Wishes