

**Math 202: Statistics for Social Sciences****Fall 2007 FINAL EXAM****Calculator OK, 2 hours and 15 minutes.**

Instructions: There are six parts to this exam I-VI. Please inspect the exam and make sure you have all 6 pages of questions. Do all your work on these pages. If you use the back of a page, make sure to indicate that.

Remember: *You must show your work to get proper credit.*

Academic Honesty Code: Koç University Academic Honesty Code stipulates that “copying from others or providing answers or information, written or oral, to others is cheating.” By taking this exam, you are assuming full responsibility for observing the Academic Honesty Code.

**NAME:** \_\_\_\_\_

Formulas:

Part I:	/20
Part II:	/20
Part III:	/15
Part IV:	/15
Part V:	/15
Part VI:	/15
Total:	/100

1) Confidence interval (CI) :  $\bar{X} \pm z SE$

$$\text{or } \bar{X} \pm t SE \quad \text{or } \hat{p} \pm z \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$(\hat{p}_1 - \hat{p}_2) \pm z SE_{2-sample}$$

$$\text{or } (\bar{X}_1 - \bar{X}_2) \pm z SE_{2-sample}$$

$$\text{or } (\bar{X}_1 - \bar{X}_2) \pm t SE_{2-sample}$$

$$\text{where } SE_{2-sample} = \sqrt{(SE_1)^2 + (SE_2)^2},$$

$$\text{and } SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \quad \text{for percentages.}$$

2) Binomial formula:

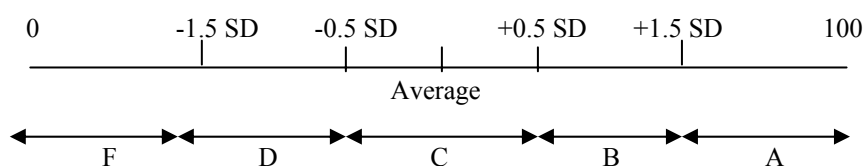
$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k} \quad k = 0, 1, 2, \dots, n$$

3) Chi-squared:  $\chi^2 = \text{sum of } \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$

4) ANOVA: Between group variance:  $s_B^2 = \frac{\sum n_i (\bar{x}_i - \bar{x}_{GM})^2}{k-1}$

Within group variance:  $s_W^2 = \frac{\sum (n_i - 1) s_i^2}{\sum (n_i - 1)}$  and  $F = \frac{s_B^2}{s_W^2}$

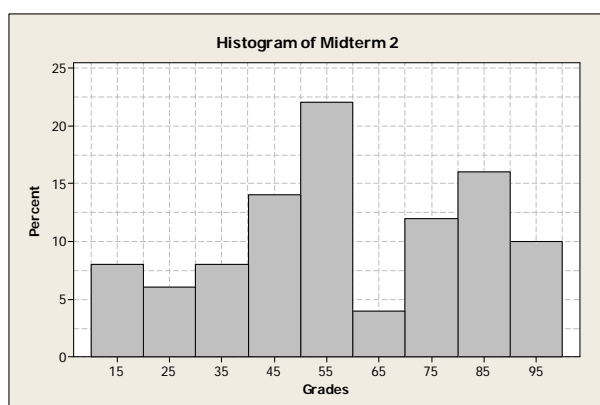
**Part I. (20 points)** Grading with a “curve” system with only A, B, C, D, F grades would be as follows: The grades in the interval “the average  $\mp 0.5$  SD (standard deviation)” would receive a C grade and so on. The grading is described on the scale below.



In this system, the grades are assumed to follow a Normal curve, from which the name originates.

1. (5 points) What percent of the students do you expect to receive a B grade?

Consider the following relative frequency histogram and the summary statistics obtained from the MT 2 grades of your class.



Variable	N	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
C1	50	58.4	3.28	23.2	14.00	42.5	57.0	80.0	98.0

2. (5 points) What are the lowest and the highest scores that fall into the B range in this exam?
3. (4 points) What is the percentage of students who receive an A grade from this exam?
4. (3 points) What is the inter-quartile range in this exam?
5. (3 points) Describe the population from which your class can be considered as a “random sample” in one sentence only.

**Part II. (20 points)** How do makers of Selpak know exactly how many tissues (=kağıt mendil) to put in a box? In a survey conducted by a marketing team, the following data have been collected for the number of times a person cleans his/her nose with a tissue during a cold (=soğuk algınlığı):

57 62 61 63 52 55 60 74 65

The producers of Selpak put 60 tissues per box believing that the true average is 60.

1. (4 points) Find the mean and the standard deviation of the sample.
2. (9 points) Perform an appropriate test of significance to decide if Selpak should continue to put 60 tissues per box. Show all steps and state your conclusion in plain English. (Hint: If you did not solve question 1, you can take the standard deviation to be equal to 6 although it is not the exact answer)
3. (2 points) What were your assumptions before making the test in question 2?
4. (5 points) If you select a person randomly from the population, what is the probability that she will clean her nose with a tissue at most 50 times during a cold? Assume normal approximation.

**Part III. (15 points)** Many hotel customers fail to cancel their reservations in a timely manner when they are not going to stay. Such customers are called “no-shows”. The number of no-shows is recorded in two different hotels, the averages being 15 and 13 customers per day as shown in the following MINITAB output for Hilton and Sheraton, respectively.

Variable	N	Mean	SE Mean	StDev
Hilton	30	15	0.53	2.9
Sheraton	40	13	0.41	2.6

1. (9 points) Construct a 95% CI for the difference in the number of no-shows per day.
2. (6 points) Is there a significant difference in the number of no-shows of the two hotels?

**Part IV. (15 points)** Recently, it has been found that the bride (=gelin) and the groom (=damat) are at the same age in 7% of a random sample of 65 married couples in Turkey.

1. (9 points) A historian thinks that the same age marriages have been about 5% over the last century based on her previous research. Is there significant evidence that such marriages have increased recently? Answer by showing all steps of a hypothesis test and stating your conclusion in plain English.
2. (6 points) According to your conclusion in part a), consider the true percentage in the population to be 5% or 7%. If you did not do part a), choose either one you like. In a new random sample of only 4 couples, what is the probability that there are two or more couples of the same age?

**Part V. (15 points)** A common core course is taken by a mixed group of students. The following table shows data for a class of 50 students, who can be categorized as qualitative and quantitative majors.

	less than 40	between 40 and 80	greater than 80
Quantitative	10	4	13
Qualitative	10	7	6

1. (5 points) What are the variables? What are their values?
2. (10 points) Is the grade distribution independent from the type of major? Test at 1% level of significance by showing all steps and stating your conclusion in plain English.

**Part VI. (15 points)** Starting salaries of graduates of three different majors of Koc University are given in the following table for 2007, where the numbers are simplified by changing each unit equivalent to 100 YTL. For example the salary “12” corresponds to  $12 \times 100 = 1200$  YTL. Each group below is a random sample from the corresponding major. Are the starting salaries of the three majors different on the average? Use the simplified numbers for your analysis.

	Major A	Major B	Major C
	12	15	9
	14	30	14
	9	13	9
	8	10	8
	23	11	11
		8	8
			11
			12
Mean ( $\bar{x}$ )	13.2	14.5	10.3
Standard Deviation ( $s$ )	6	8	2.1
Variance ( $s^2$ )	36	64	4.4

Hint: The average of all 19 of the salaries is 12.4 ( $\times 100$  YTL=1240YTL)