Kuwait University
College of Science
Department of Statistics and Operations Research

Stat 101

New Homework Booklet

First Term 2013/2014

Name		ID Number		Lab Section	

Homework # 1

Problem 1

For each of the following cases, indicate whether the variable is qualitative or quantitative (specifying in the second case whether it is discrete or continuous).

    a. High school GPA of those who applied for admission to Kuwait University in Spring 2012

    b. Entry level salary of students who graduated from Kuwait University in Fall 2012

    c. Age of applicants for a computer technician position (advertised in December 2012) within the College of Science of Kuwait University

    d. Gender of students enrolled in all sections of Stat 101 during Spring 2012

    e. Educational institution where the teaching staff working currently within the Statistics and Operations Research department earned their PhD degrees

    f. Color of the cars driven by the 2012 players of the handball national team of Kuwait

Problem 2

Indicate whether each of the following constitutes a population or a sample.

    a. One hundred students admitted to Kuwait University in Spring 2012

    b. All non-technical support staff currently working for Kuwait University

    c. All female students graduating from Kuwait University in spring 2012

    d. One thousand applicants for jobs advertised by Microsoft in December 2012

    e. All students enrolled in all courses offered by the College of Science of Kuwait University in Fall 2012

    f. All students who were enrolled in Stat 101 during Fall 2012

Problem 3

Indicate for each of the following the population, the sample, the variable, and its type. Provide an example of a possible observation for each case.

a. Income of 10 physicians practicing in Kuwait City in January 2010

b. Number of accidents that occurred along the 4th ring road on 15 random days of summer 2013

c. Blood type of 20 Kuwait University students enrolled in Stat 101 of Summer 2013

d. Number of courses already completed by 10 male students newly enrolled in the Statistics and Operations Research Department in Spring 2012

e. Weight of 15 male athletes from Al-Ahli sport club of Kuwait on the day of their medical exam in February 2013.

Problem 4

A study of the records of 300 students from the college of Social Sciences revealed that 60 persons of the sampled students were originally admitted to a different college. The University is interested in predicting the proportion of students that might transfer to the college of Social Sciences next academic year. Describe the

- population

- sample

- variable of interest and its type

- descriptive statistics

- inference of interest.

Problem 5

30 adults were asked which of the following conveniences they find essential for their lives: television (T), refrigerator (R), air conditioning (A), public transportation (P), or microwave (M). Their responses were

R	A	R	P	P	T	R	M	P	A
A	R	R	T	P	P	T	R	A	A
R	P	A	T	R	P	R	A	P	R

1. Prepare a frequency distribution table. Also give the relative frequencies and percentages for all categories.

2. What percentage of these adults named refrigerator or air conditioning as the convenience that is essential for them?

3. Draw a bar graph for the relative frequency distribution.

4. Draw a pie chart for this data.

Problem 6

The following data give the time (in minutes) that each of 20 students waited in line at their bookstore to pay for their textbooks in the beginning of Spring 2013.

15	8	23	21	5	17	31	22	34	6
5	10	14	17	16	25	30	3	31	19

1. Construct a stem and leaf plot for these data.

2. Construct a dot plot.

3. Comment on the skewness of the data.

4. Find the mean, median, and mode.

5. Compute the range, variance, and standard deviation.

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Homework # 2

Problem 1

A box contains 20 computer parts; of which 4 are defective. Two parts are selected at random from this box and inspected to determine if they are good (G) or defective (D).

1. Draw a tree diagram for this experiment.

2. How many total outcomes are possible? Write these outcomes in a sample space S.

3. List the outcomes included in each of the following events:

    a. At least one part is good.

    b. Exactly one part is defective.

    c. The first part is good and the second is defective.

    d. At most one part is good.

Problem 2:

Which of the following can't be probabilities of events?

  1/5   0.97   -0.55   1.56   5/3   0.0   -2/7   1.0

Problem 3

In a statistics class of 50 students, 20 have volunteered for community service in the past. If one student is randomly selected from this group,

  1. What is the probability that he or she

    a. has volunteered for community service in the past?

    b. has never volunteered for community service in the past?

  2. Do these probabilities add to 1.0?

Problem 4

1. Given that A, B, and C are independent events, find P(A and B), P(A and B and C) if P(A) = 0.20, P(B) = 0.46, and   P(C) = 0.25

2. Given that P(A) =0.30, and P(A and B) = 0.24, find P(B|A).

3. Given that P(A|B) =0.40, and P(A and B) = 0.36, find P(B).

4. Find P(A or B) if P(A) =0.58, P(B) = 0.66, and P(A and B) = 0.57

5. Given that A and B are mutually exclusive events, find P(A or B) if P(A) = 0.55, and P(B) = 0.25

Problem 5

The following two-way Table gives the responses of a random sample of 200 adults.

	Have Shopped on the Internet	Have Never Shopped on the Internet
Male	35	85
Female	15	65

1. If one adult is selected at random from these 200 adults, find the probability that this adult
   a. Has never shopped on the Internet

   b. Has shopped on the Internet given that this adult is a female

2. Are the event "male" and "female" mutually exclusive? Why or why not?

3. Are the event "Have shopped" and "male" mutually exclusive? Why or why not?

4. Are the event "Have shopped" and "female" independent? Why or why not?

5. If one adult is selected at random from these adults, find the probability that this adult
   a. Has never shopped on the Internet and is a male

   b. Has never shopped on the Internet or is a female

   c. Has shopped on the Internet or has never shopped on the Internet

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Homework # 3

Problem 1
Each of the following tables lists certain values of x and their probabilities. Verify whether or not each represents a valid probability distribution.

a.

x	P(x)
0	.10
1	.50
2	.45
3	.40

b.

x	P(x)
2	.35
3	.28
4	.20
5	.14

c.

x	P(x)
7	-.25
8	.85
9	.40

d.

x	P(x)
7	0.25
8	0.60
9	0.15

Problem 2
A sporting shop sells exercise machines. On different days, it sells different numbers of these machines. The following table lists the probability distribution function of the number of machines sold per day at this shop.

# of Machines sold	4	5	6	7	8	9	10
Probability	.1	.2	.11	.19	.2	.16	.04

1. Graph the probability distribution.

2. Determine the probability that the number of exercise machines sold by this shop on a given day is
   i. Exactly 6

   ii. More than 8

   iii. 5 to 8 inclusive

   iv. At most 6

3. Calculate the mean and standard deviation for this probability distribution.

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Problem 3

An instant lottery ticket costs $5. Out of a total of 10000 tickets printed for this lottery, 1000 tickets contain a prize of $2 each, 100 tickets have a prize of $10 each, 5 tickets have a prize of $1000 each, and 1 ticket has a prize of $5000. Let X be the net amount a player wins/loses by playing this lottery once.

1. Write the probability distribution of X.

2. Determine the mean and standard deviation of X.

3. How do you interpret the value of the mean?

Problem 4

1. An environmental agency will randomly select 4 houses from a block containing 25 houses for a random check. How many total selections are possible?

2. An English department at a university has 16 faculty members. Three faculty members will be randomly selected to represent the department on a committee. In how many ways can the department select three faculty members from 16?

3. In how many ways can a sample (without replacement) of 9 items be selected from a population of 20 items?

Problem 5

In a survey of adults in December 2012, 30% of the respondents said they feel stress in their daily lives. Assume that this percentage is true for the current population of all adults. In a random sample of 15 adults, find the probability that the number who feel stress is

a. At most 9

b. At least 11

c. 10 to 12

d. None

e. Exactly 10

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Homework # 4

Problem 1

1. For a normal distribution with mean μ and variance σ^2, find the area between $\mu-1.5\sigma$ and $\mu+1.5\sigma$.

2. Find the area under the standard normal curve
   a. Between $z = 0.12$ and $z = 2.15$

   b. From $z = -2.35$ to $z = 1.46$

   c. Between $z = -1.58$ to $z = -2.41$

   d. To the right of $z = -1.92$

3. Determine the following probabilities for the standard normal distributions
   a. $P(-2.05 \leq Z \leq 1.38)$

   b. $P(Z \geq 0.85)$

4. Let X be a continuous random variable that has a normal distribution with a mean of 4 and a standard deviation of 5. Find the probability that X assumes a value
   a. Between 2.15 and 7.95

   b. Between 3.5 and 12.5

5. Find the value of z so that the area under the standard normal curve
   a. From 0 to z is 0.1965 and z is positive

   b. Between z and 0 is (approximately) 0.2740 and z is negative

   c. Less than z is (approximately) 0.2050

   d. More than z is (approximately) 0.1053

6. Let X be a continuous random variable that follows a normal distribution with a mean of 550 and a standard deviation of 75.
   a. Find the value of x so that the area under the normal curve to the left of x is approximately 0.9600.

   b. Find the value of x so that the area under the normal curve to the right of x is 0.0250.

   c. Find the value of x so that the area under the normal curve between μ and x is 0.4700 and the value of x is less than μ.

7. For a binomial probability distribution with n = 120 and p = 0.60. Let X be the number of successes.
   a. Find the mean and standard deviation of X.

   b. Find $P(X \le 72)$ using the normal approximation to the binomial distribution.

   c. Find $P(67 \le X \le 73)$ using the normal approximation to the binomial distribution.

Problem 2

1. Assume that the current hotel room rates per day have a normal distribution with a mean of $84 and a standard deviation of $10. Find the percentage of hotel rooms with rates

   a. Between $70 and $96

   b. Between $64 and $110

2. It is estimated that the average balances on all credit cards issued by a bank have a mean of $800 and a standard deviation of $250. Assume that the balances on these credit cards follow a normal distribution.

   a. What is the probability that a randomly selected credit card issued by this bank has a balance between $375 and $1200?

   b. What is the percentage of the credit cards issued by this bank that have a balance of $750 or more?

3. Fast auto service guarantees that the maximum waiting time for its customers is 20 minutes for oil and lube service on their cars. It also guarantees that any customer who has to wait longer than 20 minutes for this service will receive a 50% discount on the charges. It is estimated that the mean time taken for oil and lube service at this garage is 15 minutes per car and the standard deviation is 2.4 minutes. Suppose the time taken for oil and lube service on a car follows a normal distribution.

   a. What is the probability that a car takes longer than 25 minutes for oil and lube service?

   b. What percentage of the customers will receive the 50% discount on their charges?

   c. The company wants to limit this discount to at most 5% of the customers. What should the maximum guaranteed waiting time be?

4. According to a survey, 20% of ninth graders own a smart phone. Assume that this percentage is true for all current ninth graders. Find an approximation to the probability that in a random sample of 250 ninth graders, 40 to 62 own a smart phone.

5. 5% of the calculators manufactured by a company malfunction within a two-year period. The company recently mailed 500 such calculators to its customers.

   a. Approximate the probability that exactly 20 of the 500 calculators will be returned for refund or replacement within a two-year period.

   b. Approximate the probability that 35 or more of the 500 calculators will be returned for refund or replacement within a two-year period.

   c. Approximate the probability that more than 15 and less than 22 of the 500 calculators will be returned for refund or replacement within a two-year period.

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Homework # 5

Problem 1

According to a survey, the mean charges for a hotel room in the USA were $84.58 per day in 2001. Assume that the current hotel room rates have a normal distribution with a mean of $84.58 per day and a standard deviation of $12. Let $\overline{X}$ denote the mean charge for hotel rooms for a sample of 90 rooms. Find the mean and standard deviation of $\overline{X}$ and describe the shape of its sampling distribution.

Problem 2

According to the US Bureau of Labor Statistics estimates, the average earnings of construction workers were $18.96 per hour in August 2012. Assume that the current earnings of all construction workers are normally distributed with a mean of $18.96 per hour and a standard deviation of $3.60 per hour. Find the probability that the mean hourly earnings of a random sample of 25 construction workers is

1. between $18 and $20 per hour

2. within $1 of the population mean

Problem 3

1. In a population of 5000 subjects, 600 have green eyes. A sample of 120 subjects selected from this population contains 18 subjects whose eyes are green. What are the values of the population and sample proportions?

2. In a population of 9500 subjects, 75% possess a certain characteristic. In a sample of 400 subjects selected from this population, 78% possess the same characteristic. How many subjects in the population and sample respectively possess this characteristic?

Problem 4
A survey of all medium and large sized corporations showed that 64% of them offer retirement plans to their employees. Let $\hat{p}$ be the proportion in a random sample of 50 such corporations that offer retirement plans to their employees. Find the probability that the value of $\hat{p}$ will be between 0.54 and 0.61

Problem 5
A city is planning to build a hydroelectric power plant. A local newspaper found that 53% of the voters in this city favor the construction of this plant. Assume that this result holds true for the population of all voters in this city. What is the probability that more than 50% of the voters in a random sample of 200 voters selected from this city will favor the construction of this plant?

Problem 6
For a data set obtained from a sample, n=64, $\bar{x}$=24.5, and s=3.1.
    a. What is the point estimate of μ?

    b. Make a 99% confidence interval for μ.

    c. What is the maximum error of estimate for part b?

Problem 7
According to a survey, mothers with children under age 18 spent an average of 16.87 hours/week online. Suppose that this mean is based on a random sample of 100 such mothers and that the standard deviation for this sample is 3.2 hours/week. Construct a 95% confidence interval for the corresponding population mean.

Problem 8
In a poll of 617 workers, 25% said they have observed their co-workers stealing products or cash from their employers.

    a. What is the point estimate of the corresponding population proportion?

    b. Find a 95% confidence interval for proportion of all such workers who have observed their co-workers stealing products or cash from their employers.

    c. What is the maximum error of estimate for part b?

Problem 12
A department store manager wants to estimate at a 90% confidence level the mean amount spent by all customers at this store. From an earlier study, the manager knows that the standard deviation of amounts spent by customers at this store is $31. What sample size should he choose so that the estimate is within $3 of the population mean?

Problem 13
Independent random samples selected from two normal populations produced the following:

Population	n	$\bar{x}$	S^2
1	16	5	4
2	25	7	5

a. Find and interpret the 95% confidence interval for $(\mu_1 - \mu_2)$.

b. Conduct the test H_0: $(\mu_1 - \mu_2) = 0$ against H_1: $(\mu_1 - \mu_2) \neq 0$ with $\alpha = 0.05$

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Homework # 6

N.B.: Solve all questions manually and using Minitab.

1. The manufacturer of a certain brand of auto batteries claims that the mean life of these batteries is 45 months. A consumer protection agency that wants to check this claim took a random sample of 36 such batteries and found that the mean life for this sample is 43.75 months with a standard deviation of 4.5 months. Find the P-value for the hypothesis test against the alternative hypothesis that the mean life of these batteries is less than 45 months. Will you reject the null hypothesis at $\alpha = 0.025$?

2. A machine is set to fill 32-ounce milk cartons. However, the amount it puts into the cartons varies slightly from carton to carton. It is known that the standard deviation of the milk in all such cartons is always equal to 0.15 ounce. A sample of 35 such cartons produced a mean net weight of 31.90 ounce. Calculate the P-value for testing H_0: $\mu = 32$ Vs H_1: $\mu \neq 32$. Will you reject the null hypothesis at $\alpha=.01$? at $\alpha=.05$?

3. A recent random sample of 1000 Americans found that 430 of them dream of owning a business. Test at the 5% significance level if the current percentage of Americans who dream of owning a business is different from 47%.

4. An auto manufacturing company wanted to investigate how the price of one of its car models depreciates with age. The research department at the company took a sample of eight cars of this model and collected the following information on the ages (in years) and prices (in hundreds of dollars) of these cars.

Age	8	3	6	9	2	5	6	3
Price	19	94	50	21	145	42	36	99

a. Construct a scatter diagram for these data. Does the scatter diagram exhibit a linear relationship between ages and prices of cars?

b. Find the regression line with price as a dependent variable and age as an independent variable.

c. Test the significance of the regression coefficient.

d. Give a brief interpretation of the values of the intercept and slope calculated in part 2.

e. Plot the regression line on the scatter diagram of part 1 and show the errors by drawing vertical lines between scatter points and the regression line.

f. Predict the price of a 7-year old car of this model.

g. Estimate the price of an 18-year old car of this model.

h. Compute the coefficient of determination and give a brief interpretation of it.

i. Do you expect the ages and prices of cars to be positively or negatively related? Explain.

j. Compute the linear correlation coefficient.