EXERCISE 105 stat

Collected by

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Chapter 1

EXERCISE

Q1. (A) Suppose that Z is distributed according to the standard normal distribution.

1) the area under the curve to the left of $z = 1.43$ is:
   (A) 0.0764 (B) 0.9236 (C) 0 (D) 0.8133
2) the area under the curve to the left of z = 1.39 is:
   (A) 0.7268 (B) 0.9177 (C) .2732 (D) 0.0832
3) the area under the curve to the right of $z = -0.89$ is:
   (A) 0. 7815 (B) 0.8133 (C) 0.1867 (D) 0.0154
4) the area under the curve between $z = -2.16$ and $z = -0.65$ is:
   (A) 0.7576 (B) 0.8665 (C) 0.0154 (D) 0.2424
5) the value of k such that $P(0.93 < Z < k) = 0.0427$ is:
   (A) 0.8665 (B) –1.11 (C) 1.11 (D) 1.00

(B) Suppose that Z is distributed according to the standard normal distribution. Find:

1) P(Z< –3.9)
2) P(Z> 4.5)
1) P(Z< 3.7)
2) P(Z> –4.1)

Q2. The finished inside diameter of a piston ring is normally distributed with a mean of 12 centimeters and a standard deviation of 0.03 centimeter. Then,

1) the proportion of rings that will have inside diameter less than 12.05 centimeters is:
   (A) 0.0475 (B) 0.9525 (C) 0.7257 (D) 0.8413
2) the proportion of rings that will have inside diameter exceeding 11.97 centimeters is:
   (A) 0.0475 (B) 0.8413 (C) 0.1587 (D) 0.4514
3) the probability that a piston ring will have an inside diameter between 11.95 and 12.05 centimeters is:
   (A) 0.905 (B) –0.905 (C) 0.4514 (D) 0.7257

Q3. The average life of a certain type of small motor is 10 years with a standard deviation of 2 years. Assume the live of the motor is normally distributed. The manufacturer replaces free all motors that fail while under guarantee. If he is willing to replace only 1.5% of the motors that fail, then he should give a guarantee of :

(A) 10.03 years (B) 8 years (C) 5.66 years (D) 3 years

Q4. A machine makes bolts (that are used in the construction of an electric transformer). It produces bolts with diameters (X) following a normal distribution with a mean of 0.060 inches and a standard deviation of 0.001 inches. Any bolt with diameter less than 0.058 inches or greater than 0.062 inches must be scrapped. Then

(1) The proportion of bolts that must be scrapped is equal to

(A) 0.0456 (B) 0.0228 (C) 0.9772 (D) 0.3333 (E) 0.1667

(2) If P(X>a)= 0.1949, then a equals to:

(A) 0.0629 (B) 0.0659 (C) 0.0649 (D) 0.0669 (E) 0.0609

Q5. The diameters of ball bearings manufactured by an industrial process are normally distributed with a mean μ = 3.0 cm and a standard deviation σ = 0.005 cm. All ball bearings with diameters not within the specifications $\mu \pm$ d cm (d > 0) will be scrapped.

(1) Determine the value of d such that 90% of ball bearings manufactured by this process will not be scrapped.

(2) If d = 0.005, what is the percentage of manufactured ball bearings that will be scraped?

Q6. The weight of a large number of fat persons is nicely modeled with a normal distribution with mean of 128 kg and a standard deviation of 9 kg.

(1) The percentage of fat persons with weights at most 110 kg is

(A) 0.09 % (B) 90.3 % (C) 99.82 % (D) 2.28 %

(2) The percentage of fat persons with weights more than 149 kg is

(A) 0.09 % (B) 0.99 % (C) 9.7 % (D) 99.82 %

(3) The weight x above which 86% of those persons will be

(A) 118.28 (B) 128.28 (C) 154.82 (D) 81.28

(4) The weight x below which 50% of those persons will be

(A) 101.18 (B) 128 (C) 154.82 (D) 81

Q7. The random variable X, representing the lifespan of a certain electronic device, is normally distributed with a mean of 40 months and a standard deviation of 2 months. Find

1. P(X<38). (0.1587)
2. P(38<X<40). (0.3413)
3. P(X=38). (0.0000)
4. The value of x such that P(X<x)=0.7324. (41.24)

Q8. If the random variable X has a normal distribution with the mean μ and the variance σ^2, then $P(X<\mu+2\sigma)$ equals to

(A) 0.8772 (B) 0.4772 (C) 0.5772 (D) 0.7772 (E) 0.9772

Q9. If the random variable X has a normal distribution with the mean μ and the variance 1, and if P(X<3)=0.877, then μ equals to

(A) 3.84 (B) 2.84 (C) 1.84 (D) 4.84 (E) 8.84

Q10. Suppose that the marks of the students in a certain course are distributed according to a normal distribution with the mean 70 and the variance 25. If it is known that 33% of the student failed the exam, then the passing mark x is

(A) 67.8 (B) 60.8 (C) 57.8 (D) 50.8 (E) 70.8

Q11. If the random variable X has a normal distribution with the mean 10 and the variance 36, then

1. The value of X above which an area of 0.2296 lie is
   (A) 14.44 (B) 16.44 (C) 10.44 (D) 18.44 (E) 11.44
2. The probability that the value of X is greater than 16 is
   (A) 0.9587 (B) 0.1587 (C) 0.7587 (D) 0.0587 (E) 0.5587

Q1)

Find:

$$(a)\, t_{0.025} \text{ when } v = 14$$

$$(b)\, t_{0.01} \text{ when } v = 10$$

$$(c)\, t_{0.995} \text{ when } v = 7$$

Q2)

Given a random sample of size **24** from a normal distribution, find **k** such that:

$$(a)\, P(-1.7139 < T < k) = 0.90$$

$$(b)\, P(k < T < 2.807) = 0.95$$

$$(c)\, P(-k < T < k) = 0.90$$

Q3)

By using chi- square distribution ,Find:

a) $\chi^2_{0.995}\ when \ \ \nu = 19$

b) $\chi^2_{0.025}\ when \ \ \nu = 15$

c) $\chi^2_{0.95}\ when \ \ \nu = 2$

Q4)

From the tables of F- distribution ,Find**:**

a) $F_{0.995,15,22}$

b) $F_{0.005,15,22}$

c) $F_{0.9,10,8}$

Chapter 2

1) Suppose a population has N=4 elements.
   a) List all possible samples of size 2 if sampling with replacement.
   b) List all possible samples of size 3 if sampling without replacement. You only need to list the basic samples.

Repeat A) and B) if N=6.

2) For each of the following values of N and n, give the number of possible samples if sampling is done

i) with replacement and ii) without replacement

a) N=6, n=2 b) N=5, n=3 c) N=10, n=3 d) N=8, n=2 e) N=100, n=10 f) N=100, n=50

3) Suppose in a population of 4 brothers and sisters, we determine the number of children that each one has obtaining

$X_1=5$, $X_2=3$, $X_3=6$, $X_4=1$

a) Find the population mean and variance for the variable
b) Find all possible with replacement samples of size 2. For each sample, find the sample mean
c) Find the mean and variance of the distribution of the sample mean
d) Verify the values in c) by appropriate formulas

4) Suppose we have the height (in cm) for a population of 5 plants of a certain type

$X_1=30$, $X_2=27$, $X_3=31$, $X_4=33$, $X_5=29$

a) Find the population mean and variance for the variable
b) Find the without replacement (n=3) distribution of the sample mean
c) Find the mean, variance and standard deviation of the sampling distribution of the sample mean
d) Verify the formulas relating the variable's population mean and variance of the distribution of the sample mean

5) Suppose we have recorded whether or not an animal has a certain disease for a population of 6 animals:

X_1= yes, X_2= yes, X_3= no, X4= yes, X_5= no, X_6= yes.

a) Find π, the population proportion with the disease.
b) Find the without replacement (n=4) distribution of p, the sample proportion with the disease.
c) Find the with replacement (n=4) distribution of p.
d) For each b) and c), find the mean and variance of the sample distribution and verify the formulas relating these values to the population proportion.

Chapter 3&4

1. For a sample of 10 fruits from thirteen-year-old acidless orange trees, the fruit shape (determined as adiameter divided by height) wae measured [Shaheen and Hamouda (1984b)]:
1.066 1.084 1.076 1.051 1.059 1.020 1.035 1.052 1.046 0.976
Assuming that fruit shapes are approximately normally distributed, find and interpret a 90% confidence interval for the average fruit shape.

2. For the data of Exercise 2.1.[Mashady and Youssef (1983) chemically evaluated irrigation water samples from 14 Qatif wells. The percent of Na cations (out of the total cations) in the water was measured:
43 47 40 45 45 48 47 47 46 52 50 50 51 49]
Find and interpret a 95% confidence interval for the average percent of Na cations in wells.

3. For the study of Exercise 2.2. [In a sample of 185 people in the Western Region who had a particular bacterial infection, the mean egg count (per gram of stool) was 141 [Ghandour et. al. (1991)]. Assume that egg counts of such people are normally distributed with a variance of 3025.]
Find and interpret a 90% confidence interval for the average egg count.

**Exercise 2.2. In a sample of 185 people in the Western Region who had a particular bacterial infection, the mean egg count (per gram of stool) was 141. Assume that egg counts of such people are normally distributed with a variance of 3025. Can we conclude that the true mean egg count is different from 130. . Use α=0.10.

4. Suppose for large population with variance 5. we want a 99% confidence interval of width 1. find the sample size needed.

5. Bacteria can under certain conditions penetrate the shell pores of eggs and may cause the egg not to hatch. In a study on the bacterial contamination of hatching eggs [Based on Barbour and Nabbut (1983)], the bacterial count was measured for eggs from layer hens and for eggs from hens raised for meat obtaining

	Sample size	**Mean**
Layer	28	5.3
Meat	24	8.8

Assuming normal population with a variance of 2 for layer hens and 3 for meat hens

a) Test whether the average bacterial count for meat hens is higher than that for layer hens. Use α=0.05.

b) Find and interpret a 90% confidence interval for the difference in average bacterial counts for the two types of hens.

6-

The phosphorus content was measured for independent samples of skim and whole

Whole: 94.95 95.15 94.85 94.55 94.55 93.40 95.05 94.35 94.70 94.90

Skim: 91.25 91.80 91.50 91.65 91.15 90.25 91.90 91.25 91.65 91.00

Assuming normal populations with equal variances

a) Test whether the average phosphorus content of skim milk is less than the average phosphorus content of whole milk. Use $\alpha=0.01$

b) Find and interpret a 99% confidence interval for the difference in average phosphorus contents of whole and skim milk

7-. Obesity, the condition of being very over weight, increases a persons risk for various health problems. One surgical procedure used to deal with obesity is called bariatric surgery and attempts to decrease theamount of food that a person can eat. In a study of obese Saudis operated on by bariatric surgery [Mofti and Al-Saleh (1992)], the weights of 31 obese Saudis were measured before and two years after surgery:

Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
148	78	120	75	117	120	143	72
145	78	150	89	122	81	134	71
123	80	102	70	149	95	151	76
140	81	154	130	109	67	129	61
129	87	114	60	137	63	131	89
119	70	129	70	154	83	129	60
151	94	148	70	110	70	108	71
122	79	113	60	107	80		

Find and interpret a 95% confidence interval for the difference in the average weight of obese Saudis before and two years after receiving bariatric surgery.

8- In an experiment comparing 2 feeding methods for caves, eight pairs of twins were used – one twin receiving Method A and other twin receiving Method B. At the end of a given time, the calves were slaughtered and cooked, and the meat was rated for its taste (with a higher number indicating a better taste):

Twin pair	Method A	Method B
1	27	23
2	37	28
3	31	30
4	38	32
5	29	27
6	35	29
7	41	36
8	37	31

Assuming approximate normality, test if the average taste score for calves fed by Method B is less than the average taste foe calves fed by Method A. Use α=0.05.

2.46. In a study on chemical weed control for potatoes in Saudi Arabia[Based on Tamim and Kadous (1984)], a herbicide DCPA (dimethyl tetrachloro terephthalate) was applied at two rates 6.7 and8.97 kg/ha. The potato girth size (in mm) was measured obtaining

		Sample size	Mean	Standard deviation
Rate	6.7	10	37.82	4.89
	8.97	10	36.39	1.60

Assuming normal populations with unequal variances.

a) Test whether the variance of potato girth size for the 6.70 rate is more than the variance for the 8.97 rate. Use α=0.05.

b) Find and interpret a 90% confidence interval for the ratio of the variances in the two rate groups.

2.32. Thirty-two Australian sheep imported to Saudi Arabia were randomly assigned to two dietary energy levels medium (2.32 Mcal of ME/kg) and high (2.74 Mcal of ME/kg) . All sheep were group-fed at 3% of their body weight daily and slaughtered at the end of a fixed period. The body wall thickness was measured [Based on abounheif and Al-Haowas (1990)]: **Medium:** 2.1 2.2 2.8 2.4 2.3 2.4 2.1 2.5 2.1 2.0 2.3 2.2 2.6 2.3 2.7 1.9

High : 2.9 2.1 2.8 2.2 2.7 2.8 2.5 2.6 2.5 2.6 2.8 2.2 2.5 2.7 2.2 2.0

Assuming normal populations with equal variances,

a) Test whether the average body wall thickness of the high energy level group more than the average for the medium energy level group. Use $\alpha=0.10$.

b) Find and interpret a 95% confidence interval for the difference in the average body wall thickness in the two energy level groups.

2.34. Two independent samples of dates were taken-one from dates in the Khalal stage and one from dates at the Tamr stage. The calcium (in mg/100g) was measured [Sawaya (1986)]:

Khalal:30,57,29,23,55,50,49,74,101,97,79,158,112,107,93,63,70,90,98,48,75,64,71,72,146,37, 82,19,115,36,34,27,38,42,18,21,75,37,80,72,73,198,107,107,35,56,25,35,26,40,75,109,27,101

Tamr:14,25,21,18,28,14,19,20,44,18,24,47,19,52,31,38,41,39,35,16,47,26,26,30,81,18,42,9,49,2 3,27,14,15,17,10,16,18,14,13,32,42,55,42,27,30,17,24,14,20,17,48,20, 76

Assuming normal populations with unequal variances ($\alpha=0.05$)

a) Test whether the average calcium of dates at the khalal stage is more than this average for Tamar stage dates

b) Find the confidence interval for the difference in the average calcium of dates at the two stage

2.43. In a sample of 54 Abhawi cameles age 1.5-3 years old, the carcass weight (in kg) was measured with a mean of 177.6 and a standard deviation of 3.6 [Abouheif et al. (1985)]. If we assume normality

a) Test whether the variance of the carcass weight is different from 20. Use $\alpha=0.05$.

b) Find and interpret a 95% confidence interval for the variance.

3.2. In a sample of 86 tomato plants grown in commercial greenhouses in a particular Algerian city, 74 were found to be infected with either one or both of tomato mosaic virus and the cucumber mosaic virus [Based on Badr (1989)]

a) Test whether the proportion of infected tomato plants is more than 75%. Use level of significance of 0.05.

b) Find and interpret a 99% confidence interval for the proportion of infected tomato plants.

c) If we know nothing about the proportion, what sample size from the larg population of tomato plants in this city is needed to get 99% confidence interval of width 0.1.

3.7. In a study on Baladi chickens, samples of incubated eggs from Baladi chickens and from single comb white Leghorn chickens (purebred for 12 years in theSaudi environment) were measured for whether or not fertile [Alsobayel (1985)]:

	Sample size	Percent fertile
Baladi	200	47%
Leghorn	200	90%

a) Find and interpret a 95% confidence interval for the difference in the proportions that are fertile for eggs from Baladi and Leghorn chickens.

b) Test whether the proportion of Baladi egg that are fertile is less than the proportion of leghorn eggs that are fertile. Use α=0.01. Find p-value.

Chapter 5

3.13. Suppose that wind in Riyadh from May to September comes from one of the directions – south (S), southeast (SE), northeast (NE) or northwest (NW). For a sample of such days the following frequencies are observed [Based on Hummeida and Mohammad (1993)]:

Wind Direction				
S	SE	NE	NW	Total
25	8	13	14	60

Using α=0.10,

a) Test if the wind directions in Riyadh from May to September occur with equal proportions.

b) Test if the frequency of the wind directions in Riyadh during this time is different from a 9:2:5:4 ratio.

3.14. Suppose we measure the strength of the shell of an egg for a sample of white chicken eggs and obtain the following frequencies:

Strength of Shell			
Weak	Moderate	Strong	Total
37	68	45	150

Using α=0.05,

a) Test if the levels of strength of white egg shells occur with equal proportions.

b) Test if proportions of the levels of strength are different from ¼ , ½ , and ¼ respectively.

3.15. In a study on the effect of nitrogen fertilizer on the quality of fruit of local orange trees [Youssef et al. (1985)], nitrogen in the form of $(NH_4)_2SO_4$ was applied at rates 0, 1, 2, and 3 kg per tree. Independent samples of fruits were taken from the four types of trees and the number sunburned fruit was recorded:

		Fruit		
		Not Sunburned	Sunburned	Total
	Control(0)	400	50	450
Nitrogen Rate Per Tree	1 kg	292	35	327
	2 kg	345	35	380
	3 kg	452	33	485

Test whether the proportions of sunburned fruits are the same for trees receiving the 4 nitrogen rates. Use α=0.05.

3.16. Formation of vitamin D depends on exposure to ultraviolet radiation in sunlight. A sample of Saudis was classified by the type of residence and the level of vitamin D [Sedrani et al. (1992)]:

	Vitamin D Level			
Residence type	Insufficient < 5 ng/ml	Low 5-10 ng/ml	Sufficient > 10 ng/ml	Total
Tent	6	31	97	134
Mud house	16	73	349	438
Flat	45	174	652	871
Villa	64	323	1061	1448
Brick house	51	250	886	1187
Total	182	851	3045	4078

Test whether the Vitamin D level of Saudis is related to the type of residence. Use a level of significance of 0.05.

3.19. A sample of medical students was classified by smoking habit and the source of information about the dangers of smoking obtaining the following frequencies [Jarallah (1992)]:

	Habit		
Source	Non Smoker	Smoker	Total
School	15	6	21
Doctors	18	12	30
Media	62	41	103
Others	21	11	32
More than one	159	64	223
Total	275	134	409

Can we conclude that the smoking habit is related to the source of information about dangers of smoking. Use $\alpha=0.05$.

3.20. Random samples of 4 types of fish in the Arabian Gulf were examined for the presence or absence of helminth parasites obtaining the counts [El-Naffar et al. (1992)]:

		Fish type				
		1	2	3	4	Total
helminth parasites	Present	136	78	104	55	373
	Absent	80	42	61	35	218
	Total	216	120	165	90	591

Can we conclude that the proportions of present ant absent parasites are the same for the four types of fish. Use a level of significance of 0.10.

Chapter 6

1)

In a study on the growth of melon ladybird beetles, females were randomly assigned to 4 different vegetable leaf diets - cucumber, snake cucumber, squash and watermelon leaves. The number of eggs deposited by each female was recorded [Based on Ali and El-Saeady (1980)]:

Host Plant Type

Cucumber	Snake Cucumber	Squash	Watermelon
225	377	310	363
209	391	303	354
215	385	321	347
199	364	291	373
206	388	313	365

a) Test whether there is a difference in host plant types on the average number of eggs deposited by female melon ladybird beetles. Use $\alpha = 0.05$.

b) If needed, make mean separation. Interpret.

2)

Samples were collected from three types of figs and the calcium (as a percent) was measured [Based on Saad et al. (1979)]:

Fig Type

1	2	3
0.594	0.561	0.569
0.632	0.573	0.585
0.626	0.580	0.605
0.587	0.559	0.583
0.592	0.593	0.552
0.587	0.608	0.562

a) Test whether the three fig types have different average levels of calcium. Use $\alpha = 0.01$.

b) If needed, make mean separation. Interpret.

3)

In a study on the effect of replacing cow's milk with fresh camel milk butterfat in the recipe of a layer cake, the moistness rating of each of 4 cakes in a level was determined by a group of panelists [Based on Al-Mana (1992)]

Replacement Levels				
0	25	50	75	100
10.0	9.5	9.7	8.5	6.6
9.9	8.9	9.8	7.9	7.0
9.9	9.3	9.3	7.5	6.7
9.7	9.1	9.6	8.1	6.9

a) Test whether the replacement levels have different effects on the average moistness rating of a layer cake. Use $\alpha = 0.05$.

b) If needed, make mean separation. Interpret.

4)

In a study, the interest was in the effect of four methods of irrigation on the fresh weight (in g) of lettuce plants. Available for use in the study were two lettuce varieties - Dark Green and Great Lakes. Four plants of each type were randomly assigned to the four treatments [Idea from Abdulla et al. (1981)]:

	Irrigation Method			
Variety	1	2	3	4
Dark Green	8.14	9.24	16.36	4.79
Great Lakes	4.59	6.56	15.37	4.18

Assuming no interaction between irrigation methods and varieties, test whether there is a difference in irrigation methods on the average fresh weight of lettuce. Use $\alpha = 0.05$ and separate the means if necessary.

5)

Four types of fungi were used in an experiment to learn about the effect of cigarette smoke on fungal growth. Fungal cultures of the 4 types were randomly exposed to one of the smoke of 0, 2, 6, or 8 cigarettes. The rate of growth of the diameter (in mm) was measured [Based on Bokhary (1991)]:

	Number of Cigarettes Used			
Fungus	0	2	6	8
1	17.4	8.1	4.0	1.2
2	12.2	7.1	3.9	0.7
3	15.0	10.2	4.9	1.2
4	18.5	9.9	3.9	0.8

Assuming no interaction, test whether the four levels of the number of cigarettes used for smoke have different effects on the average diameter growth rate of fungi. Use $\alpha = 0.01$ and separate the means if necessary.

Chapter 8

If the data of the variables X and Y is given as follows:

$\sum x = 30$, $\sum y = 17$, $\sum xy = 91$, $\sum x^2 = 150$, $\sum y^2 = 59$, $n = 8$, then:

1) $\bar{x} =$
   a) 2.125 b) 3.75 c)5 d) none of these
2) $\bar{y} =$
   a) 2.125 b) 3.75 c)5 d) none of these
3) $S_{xx} =$
   a)37.5 b) 22.875 c) 27.25 d) none of these
4) $S_{yy} =$
   a)37.5 b) 22.875 c) 27.25 d) none of these

5) $S_{xy} =$
   a)37.5 b) 22.875 c) 27.25 d) none of these
6) $b =$
   a) 0.727 b) - 0.6 c)1.19 d) none of these
7) $a =$
   a) 0.727 b) - 0.6 c)1.19 d) none of these
8) The regression equation of y on x is:
   a) y=- 0.6+0.727x b) y=1.19+0.727x c) y=1.19-0.6x d) none of these

9) If X=10 then the predictive value is:
   a) $\hat{y} = 8.46$ b) $\hat{y} = 6.67$ c) $\hat{y} = -4.81$ d) none of these

10) The determination coefficient r^2 is:
   a) 0.9304 b) 0.8656 c) 0.9646 d) none of these