University of Technology
Building and Construction Engineering Department
Final Exam 2014-2015

Subject: Engineering Statistics
Division: All divisions
Examiner: Committee

Year: 2^{nd} ; **Course:** 4^{th}
Time: 3 hours
Date: / 6 /2016

[Answer 4 questions only]- [أجب عن اربعة اسئلة فقط]

Q1: The frequency table below shows the results of compressive strength of Self-consolidation concrete.

Class interval(N/mm^2)	30 - < 35	35 - <40	40 - <45	45 - <50	50 - <55	55 - <60
Frequency	6	5	6	5	4	4

1. Construct a histogram, frequency table?
2. Calculate mean, variance, and standard deviation?
3. Calculate the percentage of the compressive strength ≥ 42 N/mm^2?

(25%)

Q2: The number of flaws in bolts of cement based board products is assumed to be Poisson distributed with a mean of (0.1) flaw per square meter.

a-what is the probability that there is one flaw in 10 square meters of boards?
b-what is the probability that there are no flaws in 20 square meters of boards?
c-what is the probability that there are two flaws in 1 square meter boards?

(25%)

Q3: The diameter of a shaft in an optical storage drive is normally distributed with `mean 0.2408 inch and standard deviation 0.0005 inch. The specifications on the shaft are 0.2400 ± 0.001 inch.

a) What proportion of shafts conforms to specifications?
b) If the process is centered so that the process mean is equal to the target value of 0.2400, then what proportion of shafts conforms to specifications now?

(25%)

Q4: A random sample of size $n_1=18$ is selected from a normal population with a mean of 90 and standard deviation of 15. A second random sample of size $n_2=25$ is taken from another normal population with mean 85 and standard deviation 20. Let of $\overline{x_1}$ and $\overline{x_2}$ be the two samples means. Find:

a) The probability that $\overline{x_1} - \overline{x_2}$ exceeds 8?
b) The probability that $7.5 \leq \overline{x_1} - \overline{x_2} \leq 9.5$?

(25%)

Q5: The random variable X has a Binomial Distribution with n=10 and P=0.6. Determine the following probabilities:

a) $P(X=7)$ b) $P(X\leq 2)$ c) $P(X\leq 8)$

(25%)

Some useful equations:

$$Z = \frac{\bar{x}_i - \mu}{\frac{\sigma}{\sqrt{n}}} \quad \text{or} \quad Z = \frac{\bar{x}_i - \mu}{\sigma}$$

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$P(x = x_i) = \binom{n}{x} p^x q^{n-x}$$

$$P(x = x_i) = \frac{e^{-\lambda} \cdot \lambda^x}{x!}$$

$$\sigma^2 = \frac{\sum (x_i - \bar{x})^2 P_i}{n-1}$$

Q1

class interval	f_i	x_i	$x_i f_i$	$(x_i-\bar{x})^2 f_i$
30-<35	6	32.5	195	770.621
35-<40	5	37.5	187.5	200.534
40-<45	6	42.5	255	10.66
45-<50	5	47.5	237.5	67.234
50-<55	4	52.5	210	300.467
55-<60	4	57.5	230	747.148
	$\sum f_i = 30$		$\sum x_i f_i = 1315$	$\sum = 2096.664$

2) $$\text{Mean} = \bar{x} = \frac{\sum x_i f_i}{\sum f_i} = \frac{1315}{30} = 43.833$$

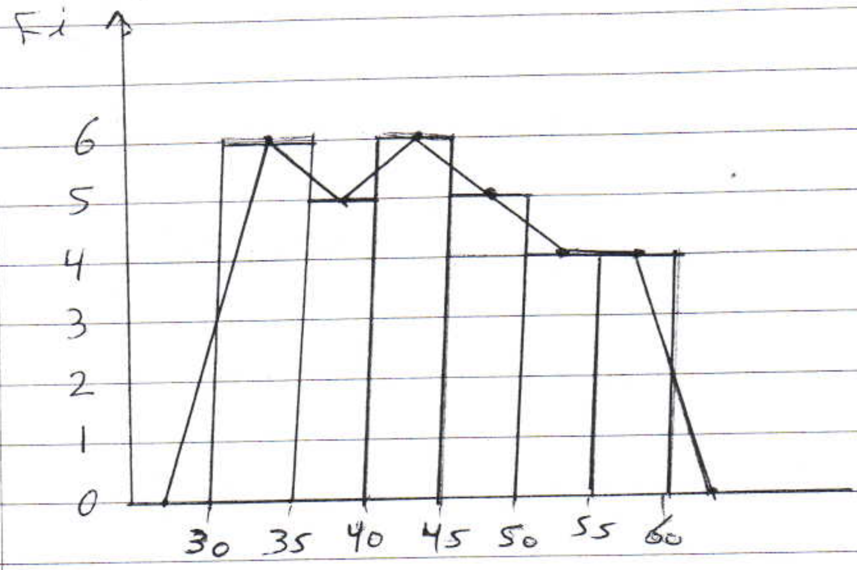
$$S^2 = \frac{\sum (x_i-\bar{x})^2 f_i}{\sum f_i} = \frac{2096.664}{30} = 69.89$$

$\frac{\sum (x_i-\bar{x})^2 f_i}{}$ For $n-1$

$$S = \sqrt{69.89} = 8.36 \approx 8.4 \text{ or } 8.5$$

3) $$P(X \geq 42) = \frac{3*6 + 5*5 + 5*4 + 5*4}{5*30}$$

$$= 0.5533$$



Fi
6
5
4
3
2
1
0
30
35
40
45
50
55
60

Q2:

Q2/The number of flaws in bolts of cloth in textile manufacturing is assumed to be Poisson distributed with a mean of (0.1) flaw per square meter.

a-what is the probability that there is one flaw in 10 square meters of cloth?

b-what is the probability that there are no flaws in 20 square meters of cloth?

c-what is the probability that there are two flaws in 1 square meter cloth?

Sol:-

a- x=1

$\lambda=0.1*10=1$

$P(x=1) = \frac{e^{-\lambda}\lambda^{x}}{x!} \quad = \frac{e^{-1}1^{1}}{1!} = 0.3678$

b- X=0

$\lambda=20*0.1=2$

$P(x=0) = \frac{e^{-2}2^{0}}{0!} = 0.1353$

c- X=2

$\lambda=0.1$

$p(x=2) = \frac{e^{-0.1}0.1^{2}}{2!} = 0.0045$

Q3. mean $= 0.2408$ standard deviation $= 0.0005$

a) $0.2400 + 0.001 = 0.241$
$0.2400 - 0.001 = 0.239$

$$P(0.241 < X < 0.239)$$

$$P\left(\frac{0.241 - 0.2408}{0.0005}\right) < Z < \left(\frac{0.239 - 0.2408}{0.0005}\right)$$

$$P(0.4 < Z < -3.6)$$

$$0.655422 - 0.000159 = 0.6553$$

b) $$P\left(\frac{0.241 - 0.2400}{0.0005}\right) < Z < \left(\frac{0.239 - 0.2400}{0.0005}\right)$$

$$2 < Z < -2$$

$$= 0.97725 - 0.02275$$

$$= 0.9545$$

(Q4)

Q4/ a random sample of size n_1=18 is selected from a normal population with a mean of 90 and standard deviation of 15 .a second random sample of size n_2=25 is taken from another normal population with mean 85 and standard deviation 20.let$\overline{x_1}$ and $\overline{x_2}$ be the two samples means. Find

a- The probability that $\overline{x_1} - \overline{x_2}$ exceeds 8?

b- The probability that $7.5 \leq \overline{x_1} - \overline{x_2} \leq 9.5$?

a-p($\overline{x_1} - \overline{x_2}$)>8=$\frac{8-(90-85)}{\sqrt{\frac{15^2}{18}+\frac{20^2}{25}}}$ =0.5619

1-p (z<0.5619)

1-0.712260=0.28774

b-p ($7.5 \leq \overline{x_1} - \overline{x_2} \leq 9.5$)=

$\frac{7.5-5}{5.3385} \leq \overline{x_1} - \overline{x_2} \leq \frac{9.5-5}{5.3385}$

0.4682≤z≤o.8429

Z≤0.8429-z≤0.4682

0.799546-0.677242=0.122304

Q5

$$P(X=x_i) = \binom{n}{x} p^{x} q^{n-x}$$

a) $P(X=7) = \binom{10}{7}(0.6)^7(0.4)^3$

$$= \frac{10!}{7!\,3!}(0.028)(0.064)$$

$$(120)(0.028)(0.064)$$

$$= 0.215$$

b) $P(X \leq 2)$

$P(X \leq 2) = P(X=2) + P(X=1) + P(X=0)$

$= \binom{10}{2}(0.6)^2(0.4)^8 + \binom{10}{1}(0.6)^1(0.4)^9 +$

$\binom{10}{0}(0.6)^0(0.4)^{10}$

$$= \frac{10!}{2!\,8!}(0.36)(0.00066) + \frac{10!}{1!\,9!}$$

$$(0.6)(0.00026) + \frac{10!}{0!\,10!}(0.0001)$$

$$= 45(0.36)(0.00066) + 10(0.6)(0.00026)$$

$$+ (0.0001) = 0.012352$$

c) $P(X \leq 8) = 1 - P(X > 8)$

$P(X > 8) = P(X=9) + P(X=10)$

$= \binom{10}{9}(0.6)^{9}(0.4)^{1} + \binom{10}{10}(0.6)^{10}(0.4)^{0}$

$= \frac{10!}{9!\,1!}(0.01)(0.4) + \frac{\cancel{10!}}{\cancel{10!}\,0!}(0.006)$

$= 10(0.01)(0.4) + 0.006$

$= 0.04 + 0.006$

$= 0.046$

$P(X \leq 8) = 1 - 0.046 = 0.954$