



Aryabhatta Knowledge University (AKU)

Electronics and electrical engineering (ECE)

Mathematics-III

Solved Exam Paper 2019

Q (1) A) what is the Wavelet transform?

Wavelet transform:--

In mathematics, a wavelet series is a representation of a square – integrable function by a certain ortho normal series generated by a wavelet.

A function y $\hat{I} L^2$ is called an orthonormal wavelet if it can be used to define a Hilbert basis that is a complete orthonormal system. For the Hilbert space L^2 (R) of square integrable function.

The Hilbert basis is constructed as the family of Function

$$\{y_{jk} : j, k \hat{l} z \}$$

$$y_{jk}(x) = 2^{j/2} y(2^j x - k)$$

for integers j,k Î z

If under the standard inner product on $L^2(\ensuremath{\mathsf{R}})$

$$(\mathbf{f},\mathbf{g}) = \int_{-\infty}^{+\infty} f(x)g(x)dx$$

this family is orthonormal

Completeness is satisfied if every function

f $\hat{I}L^2(R)$ may be expanded in the basis of

$$f(x) = \sum_{j,k=-\infty}^{+\infty} C_{jk} y_{jk}(x)$$

with convergence of the series understood to be convergence in norm.

Such a representation of f is known as a wavelet series.

The integral wavelet transform is defined as

 $[W_y f](a,b) = 1/\ddot{O}|a| \int_{-\infty}^{+\infty} \psi(\Gamma - b)/a f(x) dx$

The wavelet coefficient C_{j,k} are th<mark>en given by</mark>

 $C_{j,k} = [W_y f] (2^{-j}, k2^{-j})$

Here, $a = 2^{-j}$ is called the binary dilation

& $b = k2^{-j}$ is the binary position

Q (2) B) For any three sets A, B, C prove that A x (B (AxB)U(AxC)

Answer: To prove : A * (B U C) = (A * B) U (A * C)

Proof :

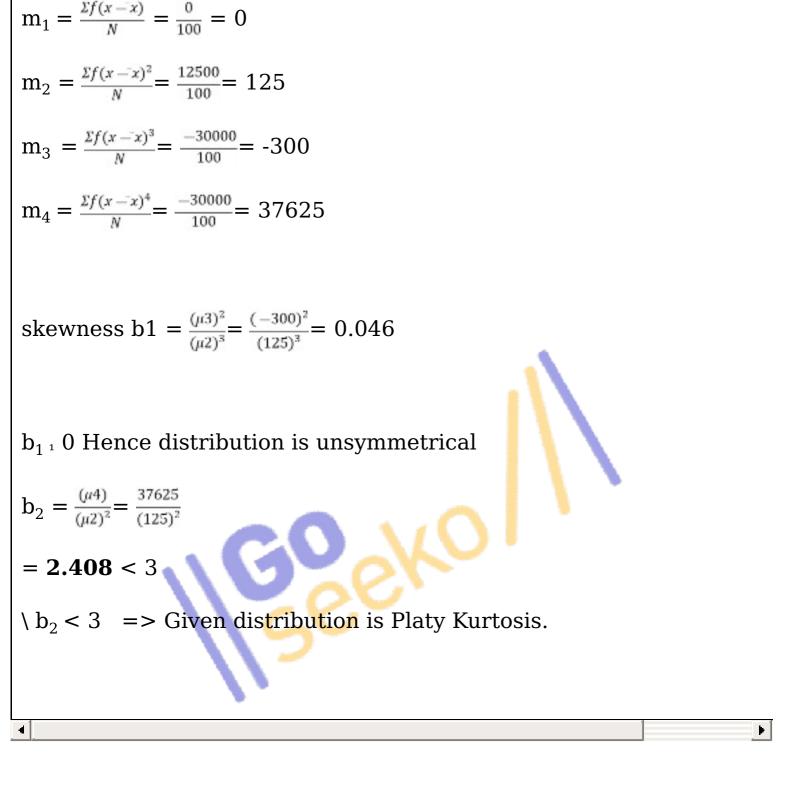
A * (B U C) = (A * B) U (A * C)

Hence Proved.

Q (3) A)Discuss Skewness and Kurtosis for the fo frequency distribution:

Marks	0-10	10- 20	20- 30	30- 40	40- 50	
No. of Students	5	10	40	20	25	
Answer: skew Step 1: - To f	(L		et	01		
class	Х			f		F _x
0-10	5			5		25
10-20	15			10		150
20-30	2	5		40		1000
30-40	35			20		700

40-50	45		25	112	1125	
	2002		N = å f = 1	00 å f	x = 3(
$\sum x = \frac{\Sigma f x}{N}$	$\frac{1}{2} = \frac{3000}{100}$					
		`x = 30				
Step 2 : -	To find cent	ral Moments :				
x	f	f(x - `x)	f(x - `x) ²	f(x - `x) ³	f(x	
5	5	-125	3125	-78125	1!	
15	10	-150	2250	-33750	5(
25	40	-200	1000	-5000	2!	
35	20	100	500	-2500	11	
45	25	375	5625	84375	1:	
	å f = 100	N =åf(x - `x) 0	=åf(x - `x) = 12500		=åf(: 376	



Q (3) B) In a partially destroyed laboratory record analysis of a correlation data, the following results a eligible:

Variance of x=9

Regression equations:

40x-18y= 214, 8x-10y+66=0

Find i) Mean values of x and, ii) the standard deviat and coefficient of correlation between x and y and iii between the lines of regressions

Answer: Given Regression Equations are 40x-18y = 214 ------ (1) & 8x - 10y + 66 = 0 ------ (2) (i) To find mean values of x and y Put x = x & y = y in given regression equations. 8 x - 10 y = -66\ 40`x - 18`y = 214by solving we get , x = 13 & y = 17(ii) To find correlation $r = \ddot{O} (bxy - byx)$ solve equation (2) for x & take of y as bxy From equation (2) = 8x = 10y-66 $x = \frac{10}{8}y - \frac{66}{8}$ $\int \mathbf{bxy} = \frac{10}{8}$

Solve equation (1) for y & take coefficient of x as by x-18y = 214 - 40x $y = \frac{40}{18}x - \frac{214}{18}$ $byx = \frac{40}{18}$ [check: bxy.Byx ≤ 1 If not then swap x <--> y & Num <--> Dero bxy.byx = $\left(\frac{10}{8}\right)\left(\frac{40}{18}\right) = 2.77 > 1$ \swap x <--> y & Num <--> Dero $byx = \frac{8}{10}\& bxy = \frac{18}{40}$] $i = \ddot{O}$ (bxy. byx) = $\ddot{O}((\frac{18}{40})(\frac{8}{10})) = 0.6$ (iii) Var (x) = 9 & var(y) = ? $byx = \frac{cov.(x,y)}{var(x)}$ $\frac{8}{10} = \frac{cov.(x,y)}{9}$ $cov.(x,y) = \frac{72}{10}$

$$\sum_{y \in \mathbf{x}} \frac{\cos(x,y)}{y \operatorname{er}(y)}$$

$$\sum_{y \in \mathbf{x}} \frac{16}{10} \frac{72}{10} \sqrt{\operatorname{var}(y)} = 16$$

$$\sum_{y \in \mathbf{x}} \frac{1}{10} \operatorname{var}(y) = 16$$

$$\sum_{x \in \mathbf{x}} \frac{1}{10} \operatorname{var}(y) = \frac{16}{10}$$

$$\sum_{x \in \mathbf{x}} \frac{1}{10} \operatorname{var}(x) = \frac{1}{10} \operatorname{var}(y) =$$

$$= \left(\frac{1-(0.6)^2}{0.6}\right) \left(\frac{3.4}{9+16}\right)$$
$$= \left(\frac{1-0.36}{0.6}\right) \left(\frac{12}{25}\right)$$

tanq = 0.512

 $\mathbf{q} = 0.47^{\circ}$

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Q (4) A) Find the mean and variance of b distribution.

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Answer: (A) Mean of Binomial Distribution

$$Mean = E(x) = \sum_{x=0}^{n} x.p(x)$$

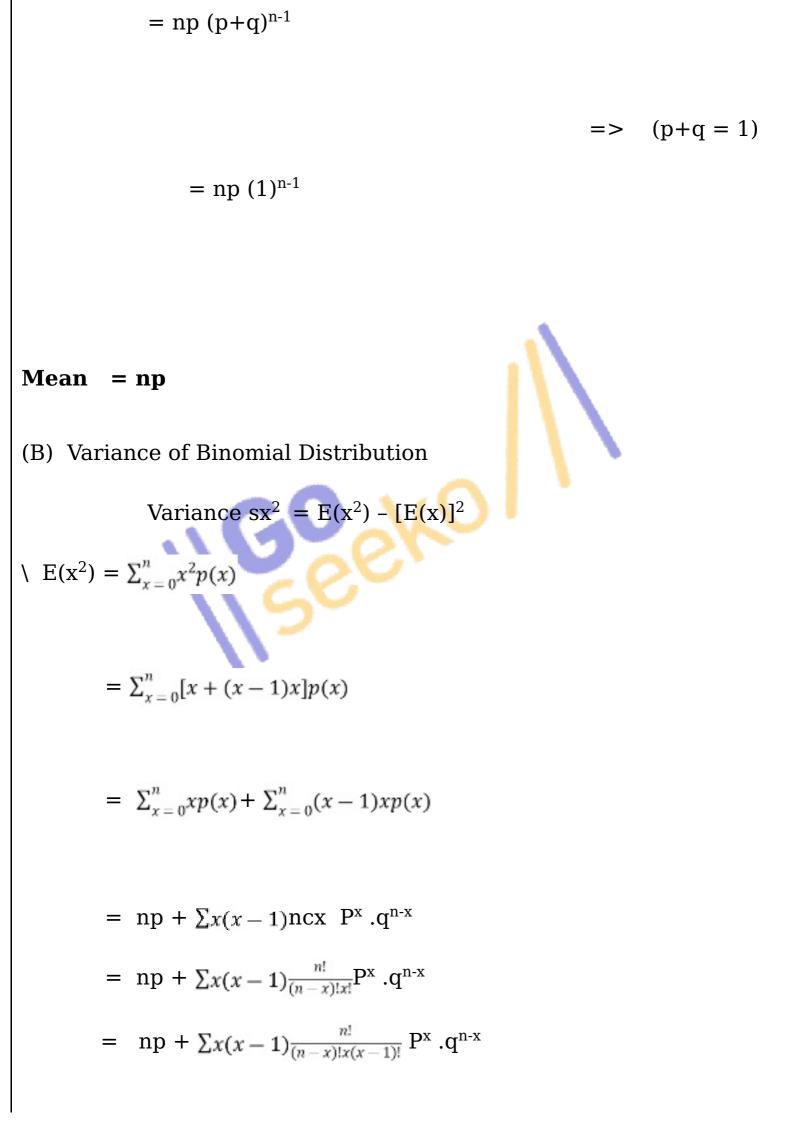
$$= \sum_{x=0}^{n} x ncx. P^{x} .q^{n-x}$$

$$= \sum_{x=0}^{n} x \frac{n!}{(n-x)!x!} P^{x} .q^{n-x}$$

$$= \sum_{x=0}^{n} x \frac{n!}{(n-x)!x(x-1)!} P^{x} .q^{n-x}$$

$$= \sum_{x=0}^{n} x \frac{n!}{(n-1)!(x-1)!(x-1)! *q!(n-1) - (x-1)!} (p.p^{x-1})$$

$$= np \sum_{x=0}^{n} x \frac{n(n-1)!}{[(n-1) - (x-1)]!(x-1)! *q!(n-1) - (x-1)]} p^{x-1}$$



Q (4) B) The probability of pen manufactured by a co

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$$= p + n^{2}p^{2} - np^{2} (1)^{n-2}$$

$$= np + n^{2}p^{2} - np^{2}$$

$$= np + n^{2}p^{2} - np^{2} - (np)^{2}$$

$$= np + n^{2}p^{2} - np^{2} - (np)^{2}$$

$$= np + n^{2}p^{2} - np^{2} - n^{2}p^{2}$$

$$= np(1-p) = > (q=1-p)$$
Variance = npq

$$= np + \sum \left(\frac{n(n-1)(n-2)!}{[(n-2)!x(x-2)]!(x-2)!} \right) p^2 \cdot p^{x-2} * q^{[(n-2)-(x-2)]}$$

 $= np + n(n-1)p^{2} \sum_{n=1}^{\infty} \left(\frac{(n-2)! * p^{(x-2)} * q^{([(n-2)-(x-2)])}}{[(n-2)-(x-2)]!(x-2)!} \right)$

 $= np + n(n-1)p^2 (p+q)^2$

will be defective is 1/10. If 12 such pens are manufa Find the probability that i) exactly two will be defec at least two will be defective and iii) none will be $eff\epsilon$ Answer: Total number of pens (n) = 12Probability of a defective pen $p = \frac{1}{10} = 0.1$ Probability of a non - defective pen q = 1 - p = 0.9[=> (p + q = 1)](a) Probability that exactly two will be defective $p(r) = ncr p^r q^{n-r}$ $p(2) = 12c2 (0.1)^2 (0.9)^{12-2}$ $\frac{12!}{2!10!}(0.1)^2(0.9)^{10}$ (p(2) = 0.2301)(b) Probability that none will be defective $p(0) = 12c0 \ (0.1)^0 \ (0.9)^{12}$ $= 1*1*(0.9)^{1}$ p(0) = 0.2824

(c)Probability that atleast two will be defective

 $p(2)+p(3)+p(4)+\dots+p(12) = 1 - [p(0) + p(1)]$ $= 1 - [0.2824 + 12c1 (0.1)^{1} (0.9)^{11}]$ = 1 - [0.2824 + 0.3766]= 0.3410

Q (5) A) In a test of 2000 electric bulbs it was found that the life of a particular make was normally distributed with an average life of 2040 hours and SD of 60 hours. Estimate the number of bulbs likely to burn for i) more than 2150 hours, ii) less than 1950 hours, and iii) more than 1950 hours and less than 2160 hours.

Answer: Given m = 2040 & s = 60

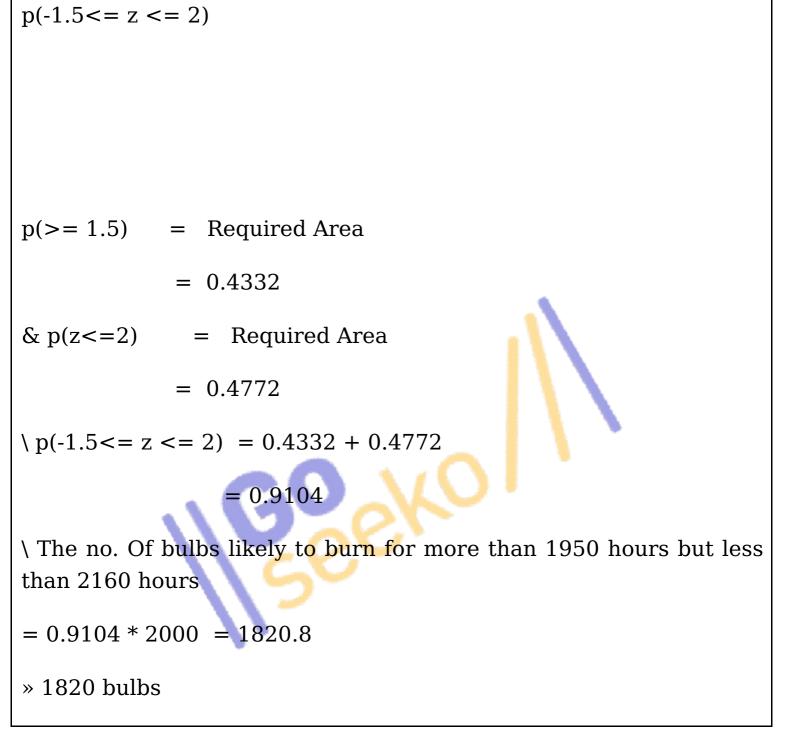
(i) For x = 2150

 $z = \frac{x - \mu}{\sigma} = \frac{2150 - 2040}{60}$

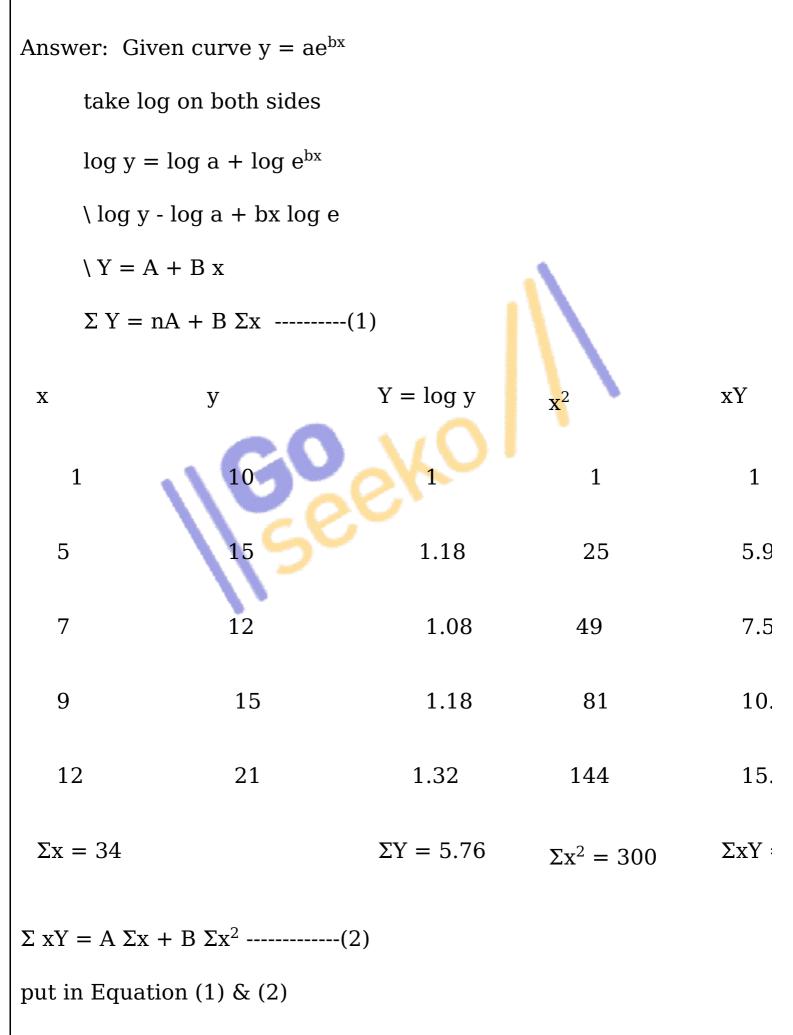
= 1.83

Area against z = 1.83 from Table = 0.4664

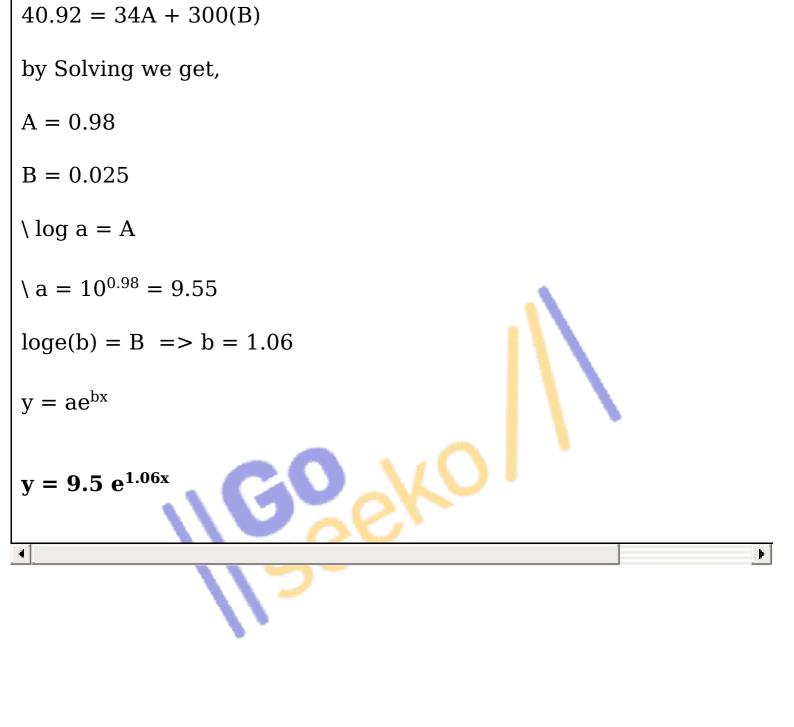
Required area = 0.5 - 0.4664= 0.0336\ The no. Of bulbs likely to burn for more than 2150 has = 0.0336 * 2000 = 67.2» 67 bulbs Less than 1950 (ii) for x = 1950 $z = \frac{x - \mu}{\sigma} = \frac{1950 - 2040}{60} = -1.5$ Area against z = -1.5 from Table = 0.4332 Required area = 0.5 - 0.43320.668 \ The no. Of bulbs likely to burn for less than 1950 has = 0.668 * 2000= 153.6»153 bulbs when x = 1950(iii) $z = \frac{1950 - 2040}{60}$ = -1.5 when x = 2160 $z = \frac{2160 - 2040}{60} = 2$



Q(5) B) Find the curve of best fit of the type y=a following data by method of least square:							
x	1	5	7	9	12		
y	10	15	12	15	21		



15.76 = 5A + 34(B)





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