University of Asia Pacific

Admit Card

Final-Term Examination of Spring, 2021

Financial Clearance	PAID

Registration No : 18101009

Student Name : Hasan Tahsin Rafsan

Program : Bachelor of Science in Computer Science and Engineering

SI.NO.	COURSE CODE	COURSE TITLE	CR.HR.	EXAM. SCHEDULE
1	CSE 400	Project / Thesis	3.00	
2	CSE 401	Mathematics for computer Science	3.00	
3	CSE 403	Artificial Intelligence and Expert Systems	3.00	
4	CSE 404	Artificial Intelligence and Expert Systems Lab	1.50	
5	CSE 405	Operating Systems	3.00	
6	CSE 406	Operating Systems Lab	1.50	
7	CSE 407	ICTLaw, Policy and Ethics	2.00	
8	CSE 410	Software Development	1.50	
9	CSE 427	Topics of Current Interest	3.00	

Total Credit: 21.50

1. Examinees are not allowed to enter the examination hall after 30 minutes of commencement of examination for mid semester examinations and 60 minutes for semester final examinations.

2. No examinees shall be allowed to submit their answer scripts before 50% of the allocated time of examination has elapsed.

3. No examinees would be allowed to go to washroom within the first 60 minutes of final examinations.

4. No student will be allowed to carry any books, bags, extra paper or cellular phone or objectionable items/incriminating paper in the examination hall.
Violators will be subjects to disciplinary action.

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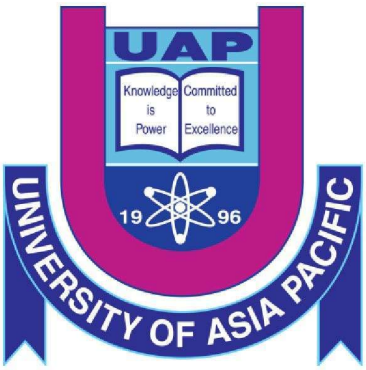
SEMESTER FINAL EXAMINATION



SPRING 2021

CSE 401

MATHEMATICS FOR COMPUTER SCIENCE

HASAN TAHSIN RAFSAN
18101009
A1 SECTION
ROLL 9
4TH YEAR
1ST SEMESTER
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
17 NOVEMBER 2021

18101009

Ans: 1

(a) Id = 18101009

Here, $n = 18119$

give to determine the value of $3^n \bmod n-1$

$$= 3^{18119} \bmod 18118$$

Formula $b^n \bmod m = n$

$$n = (18119)_{10} = (100\ 0110\ 1100\ 0111)_2$$

$a_{k-1} = a_{14}$ $\quad$ a_0

$x = 1$

power $= b \bmod m$

$= 3 \bmod 18118 = 3$

$a_0 = 1$, $x = 1 * 3 \bmod 18118 = 3$. $3^2 \bmod 18118 = 9$

$a_1 = 1$, $x = 3 * 9 \bmod 18118 = 27$ $9^2 \bmod 18118 = 81$

$a_2 = 1$, $x = 27 * 81 \bmod 18118 = 2187$ $81^2 \bmod 18118 = 6561$

$a_3 = 0$, $x = 2187$ $6561^2 \bmod 18118 = 16471$

$a_4 = 0$, $x = 2187$ $16471^2 \bmod 18118 = 13027$

$a_5 = 0$ $x = 2187$ $13027^2 \bmod 18118 = 9541$

$a_6 = 1$, $x = 2187 * 9541 \bmod 18118 = 12349$

$9541^2 \bmod 18118 = 5849$

$a_7 = 1$, $x = 12349 * 5849 \bmod 18118 = 10953$

$5849^2 \bmod 18118 = 4017$

$a_8 = 0$, $x = 10953$ $4017^2 \bmod 18118 = 11269$

$a_9 = 1$, $x = 10953 * 11269 \bmod 18118 = 9541$

$11269^2 \bmod 18118 = 1299$

$a_{10} = 1$, $x = 9541 * 1299 \bmod 18118 = 10477$

$1299^2 \bmod 18118 = 2427$

$a_{11} = 0$, $x = 10477$ $2427^2 \bmod 18118 = 1979$

$a_{12} = 0$, $x = 10477$ $1979^2 \bmod 18118 = 2953$

$a_{13} = 0$, $x = 10477$ $2953^2 \bmod 18118 = 5451$

$a_{14} = 1$, $x = 10477 * 5451 \bmod 18118 = 27$

$5451^2 \bmod 18118 = 17999$

Ans: 27

18101009

(b) $f(x,y,z) = x^2+y^2+z^2$ ——— objective

$14 = 18101009$

sum of all dig = 20 which is an-

constraint $x+2y+3z=20$ ——— constraint

we know,

$f(x,y) - \lambda * g(x,y) = 0$ ——— (1).

Here, $g(x,y,z) = x+2y+3z-20$ ———

put the value in (1).

$x^2+y^2+z^2 - \lambda(x+2y+3z-20) = 0$

$\Rightarrow x^2+y^2+z^2 - \lambda x - 2\lambda y - 3\lambda z - 20\lambda = 0$

——— (10).

partially derive x we get of (10).

$2x+0+0-\lambda-0-0-0=0$

$\Rightarrow 2x-\lambda=0$

$\Rightarrow 2x=\lambda \Rightarrow x=\lambda/2$ ———

Again, partially derive y we get of (II).

$$0 + 2y + 0 - 0 - 2\lambda - 0 - 0 = 0$$

$$\Rightarrow 2y - 2\lambda = 0$$

$$\Rightarrow 2y = 2\lambda$$

$$\Rightarrow y = \frac{2\lambda}{2} = \lambda \quad \text{——}$$

Again partially derive z, we get of (II).

$$0 + 0 + 2z - 0 - 0 - 3\lambda - 0 = 0$$

$$\Rightarrow 2z - 3\lambda = 0$$

$$\Rightarrow 2z = 3\lambda$$

$$\Rightarrow z = \frac{3\lambda}{2} \quad \text{——}$$

Now, put x, y, z in constraint

$$\frac{\lambda}{2} + 2\lambda + 3 \cdot \frac{3\lambda}{2} = 20$$

$$\Rightarrow \frac{\lambda}{2} + 2\lambda + \frac{9\lambda}{2} = 20$$

$$\Rightarrow \frac{\lambda + 9\lambda + 4\lambda}{2} = 20 \Rightarrow \frac{14\lambda}{2} = 20$$

$$\Rightarrow 7\lambda = 20$$

$$\Rightarrow \lambda = 20/7$$

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when $\lambda = \frac{20}{7}$, (positive)

$x = \lambda/2$

$= 20/7 \,/\, 2 = 10/7$

$y = \lambda = 20/7$

$z = \frac{3.(20/7)}{2} = 30/7$

similarly for negative

$x = \frac{-10}{7}$, $y = \frac{-20}{7}$, $z = -\frac{30}{7}$

$\therefore (x,y,z) = \left(\frac{10}{7}, \frac{20}{7}, \frac{30}{7}\right)$

$(x,y,z) = \left(-\frac{10}{7}, \frac{20}{7}, -\frac{30}{7}\right)$

Now, for positive end,

$f(x,y,z) = x^2 + y^2 + z^2$

$= \left(\frac{10}{7}\right)^2 + \left(\frac{20}{7}\right)^2 + \left(\frac{30}{7}\right)^2 = \frac{200}{7}$

$= 28.571$ (max)

for, negative end it'll

$$= -\left\{\left(-\frac{10}{7}\right)^2 + \left(-\frac{20}{7}\right)^2 + \left(-\frac{30}{7}\right)^2\right\}$$

$$= -\left\{\frac{200}{7}\right\} = -28.571 \text{ (min)}$$

Ans: 2

(a) · S.D = Formula

$$\sqrt{\frac{\sum_{j=1}^{n} (x_j - \bar{x})^2}{N}}$$

Id = 18101009 last dig = 9

$k = 9 + 1 = 10$

Here, S.D. of k times from mean.

Formula is

$$1 - \left(\frac{1}{k}\right)^2 * 100\%$$

$$= 1 - \left(\frac{1}{10}\right)^2 * 100\%$$

$$= \frac{99}{100} * 100\%$$

= 99% (Ans)

Id = 18101009

(b) Arithmetic mean.

Formula $\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots + x_n}{n}$

$x = 1, 8, 1, 0, 1, 0, 0, 9$

$\bar{x} = \frac{1+8+1+0+1+0+0+9}{8}$

$= \frac{20}{8} = 5/2 = 2.5$

Geometric mean

formula $G = \sqrt[n]{x_1 x_2 x_3 \cdots x_n}$

$n = 8$

$G = \sqrt[8]{1*8*1*0*1*0*0*9}$

$= 0$

Harmonic mean formula

$$H = \frac{1}{\frac{1}{n}\sum_{j=1}^{n}\frac{1}{x_j}} = \frac{n}{\sum_{j=1}^{n}\frac{1}{x_j}}$$

$$H = \frac{8}{\frac{1}{1}+\frac{1}{8}+\frac{1}{1}+\frac{1}{0}+\frac{1}{1}+\frac{1}{0}+\frac{1}{0}+\frac{1}{9}} = \infty$$

undefined, because, $\frac{1}{0}$ is not possible.

(c). Id = 18101009

mean is calculated in part (b).

Arithmatic = 2.5

Harmonic is not defined

& Geometric = 0.

For, weighted Arithmatic mean formula is $\bar{x} = \frac{n_1(x_1) + n_2x_2 + n_3x_3 + \dots + n_nx_n}{n_1 + n_2 + n_3 + \dots + n_n}$

18101009

Here, For 18101009

$x_1 = 1 \Rightarrow 3 = n_1$

$x_2 = 0 \Rightarrow 3 = n_2$

$x_3 = 9 \Rightarrow 1 = n_3$

$x_4 = 8 \Rightarrow 1 = n_4$

$$\therefore \bar{x} = \frac{1*3 + 0*3 + 9*1 + 8*1}{3+3+1+1}$$

$$= \frac{3+0+9+8}{8}$$

$$= \frac{20}{8_4} = 5/2 = 2.5$$

median

1 8 1 0 1 0 0 9

$$\text{median} = \frac{0+1}{2} = \frac{1}{2} = 0.5$$

mode. 1 8 1 0 1 0 0 9

Here, Both for 1 & 0 highest frequency is = 3. So, mode is 1 & 0.

Ans: 3

(a) · Id = 18201009

x = 1st 3 d's = 181

Y = last 3 d's = 009

(i) dataset

x_1	1	8	1
x_2	0	0	9

(ii) calculate mean

$$\bar{x_1} = (1+8+1) * \frac{1}{3} = \frac{10}{3} = 3.33\ldots$$
$$= 3.33$$

$$\bar{x_2} = (0+0+9) * \frac{1}{3} = \frac{9}{3} = 3.$$

(iii) · Cov. matrix

$$cov(x_1 x_1) = \frac{1}{N-1} \sum_{k=1}^{N} (x_{1k} - \bar{x_1})^2$$

$$= \frac{1}{2} \{(1-3.33)^2 + (8-3.33)^2 + (1-3.33)^2\}$$

$$= 16.33335$$

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$$cov(x_1, x_2) = \frac{1}{N-1} \sum_{k=1}^{N} (x_{1k} - \bar{x}_1)(x_{2k} - \bar{x}_2)$$

$$= \frac{1}{2} \{(1 - 3.33)(0 - 3) + (8 - 3.33)(0 - 3) + (1 - 3.33)(9 - 3)\}$$

$$= \frac{1}{2} * -21 = -\frac{21}{2} = -10.5$$

$$cov(x_2, x_4) = \frac{1}{N-1} \sum_{k=1}^{N} (x_{2k} - \bar{x}_2)(x_{4k} - \bar{x}_4)$$

$$= -10.5$$

$$cov(x_2, x_2) = \frac{1}{N-1} \sum_{k=1}^{N} (x_{2k} - \bar{x}_2)^2$$

$$= \frac{1}{2} \{(0-3)^2 + (0-3)^2 + (9-3)^2\}$$

$$= \frac{1}{2} * 54 = 27.$$

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So, cov. matrix

$$C = \begin{bmatrix} 16.33335 & -10.5 \\ -10.5 & 27 \end{bmatrix}$$

(iii) Eigen values.

$$\det(S - \lambda I) = 0$$

(λ → Eigen values; S → cov. matrix)

$$\Rightarrow \begin{vmatrix} 16.33335 - \lambda & -10.5 \\ -10.5 & 27 - \lambda \end{vmatrix} = 0$$

$$\Rightarrow (16.33335 - \lambda)(27 - \lambda) - (-10.5)(-10.5) = 0$$

$$\Rightarrow 441.00045 - 16.33335\lambda - 27\lambda + \lambda^2 - 110.25 = 0$$

$$\Rightarrow 441.00045 - 43.33335\lambda + \lambda^2 - 110.25 = 0$$

$$\Rightarrow \lambda^2 - 43.33335\lambda + 330.75045 = 0$$

$$\Rightarrow \lambda = 9.88980612,\ 33.44352722$$

$$\lambda = \begin{bmatrix} \lambda_1 \\ \lambda_2 \end{bmatrix} = \begin{bmatrix} 9.8898062 \\ 33.4435722 \end{bmatrix}$$ (Ans)

(iv) Eigen vector.

$$(S - \lambda_1 I)U = 0$$

$$\Rightarrow \begin{bmatrix} 16.3335 - \lambda_1 & -10.5 \\ -10.5 & 27 - \lambda_1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} (16.3335 - \lambda_1)u_1 & -10.5u_2 \\ -10.5u_1 & +(27 - \lambda_1)u_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\Rightarrow (16.3335 - \lambda_1)u_1 - 10.5u_2 = 0$$

$$\Rightarrow \frac{u_1}{u_2} = \frac{10.5}{16.3335 - \lambda_1}$$

$$e_1 = \begin{bmatrix} u_1 / \|\bar{u}\| \\ u_2 / \|\bar{u}\| \end{bmatrix} = \begin{bmatrix} -0.85 \\ -0.52 \end{bmatrix}$$ (Ans)

18201009

Similarly

$$e_2 = \begin{bmatrix} 0.52 \\ -0.85 \end{bmatrix}$$ (Ans)

Ans - 4

(B). Id = 18101009

a = 3

c = 5

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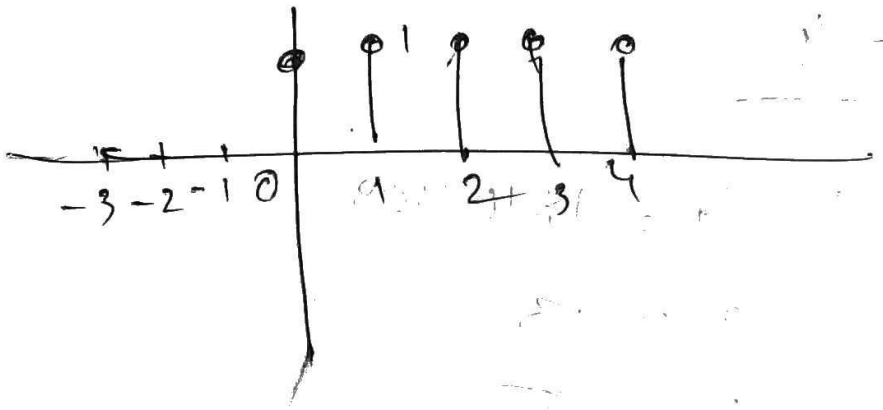
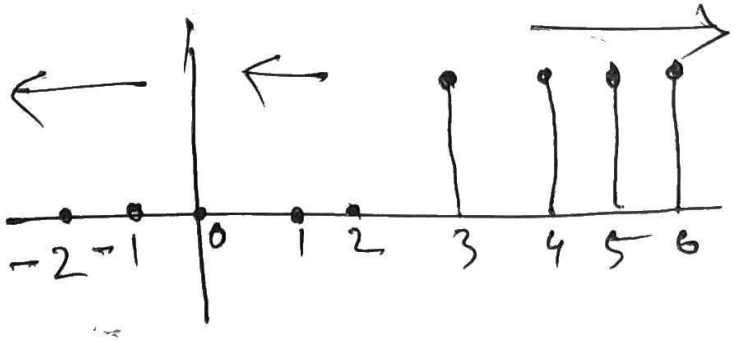
(1) u = unit step

$$u(n) = \begin{cases} 1 & n \geq 0 \\ 0 & n < 0, \end{cases}$$



u (n+a)



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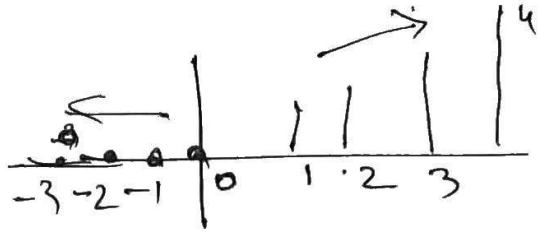
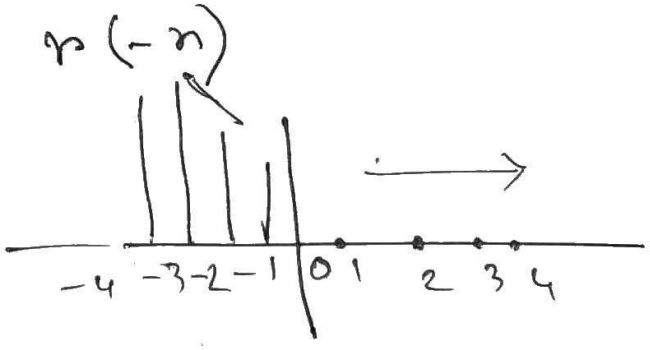
(11). r(n) = unit ramp

$$r(n) = \begin{cases} n, & n \geq 0 \\ 0, & n < 0 \end{cases}$$

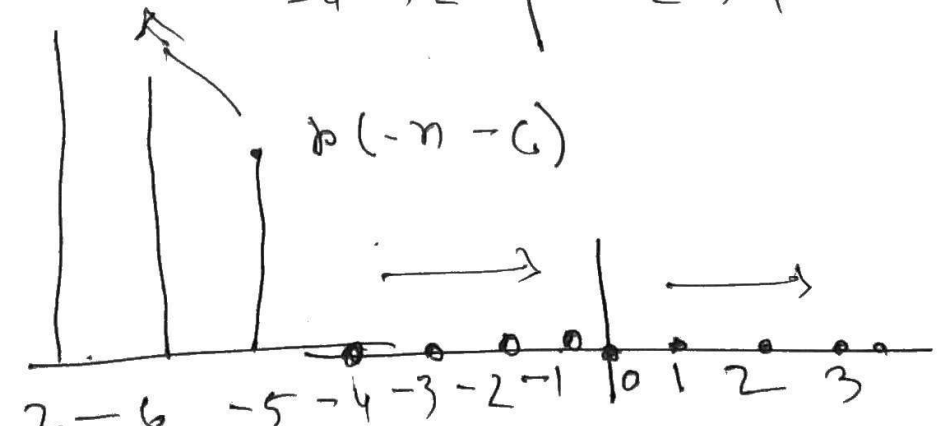


r(-n-6)

r(-n)



r(-n-6)



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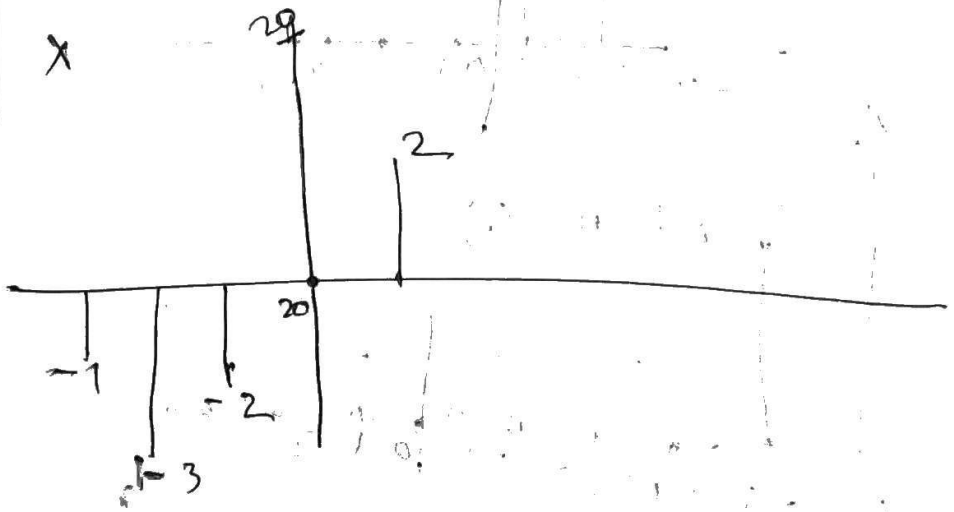
(a)

$x = [-1, -3, -2, N, -2]$

$y = [2, 3, N, -2]$

$N = 1 + 8 + 10 + 1 + 0 + 0 + 9 = 20$

x	-1	-3	-2	20	2
y	2	3	20	-2	



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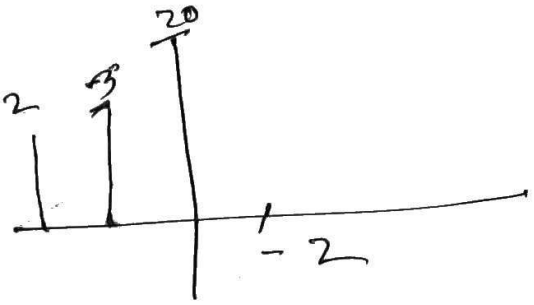
$Y =$



Final output