BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **CSE 401** (Artificial Intelligence)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) How do you answer $P(Q|e_1 \ldots e_k)$ by using inference by enumeration, where you have r hidden variables $H_1 \ldots H_r$? **(10)**

   (b) Brendan and Selen play a coin toss game to illustrate how we can use HMMs for sequence analysis problems. Brendan starts tossing first, and they take turns. The game finishes when "THT" appears, and the winner is the one who last flips the coin. At each timestep, they can flip the coin many times, and the stopping rules are as follows: **(10)**

   (i) At his turn, each time Brendan flips the coin, he also flips an extra biased coin (P(H) = 0.4.) He stops only if the extra coin lands H, otherwise he keeps flipping the fair and extra coins. The flips of the extra biased coin are not recorded.

   (ii) At her turn, Selen flips the (fair) coin until T appears (all of her flips are recorded). You are given a sequence of recorded coin flips, you would like to infer the winner and the flips of each player. Describe an HMM to model this game.

   (c) What's the degree of freedom of a car? Why it is difficult to build a robot with high degree of freedom? **(2+3)**

   (d) How does Gibbs sampling work? **(10)**

2. Consider a two-bit register. The register has four possible states: 00, 01, 10 and 11. Initially, at time 0, the contents of the register is chosen at random to be one of these four states, each with equal probability. At each time step, beginning at time 1, the register is randomly manipulated as follows: with probability ½, the register is left unchanged; with probability ¼, the two bits of the register are exchanged (e.g., 01) becomes 10); and with probability ¼, the *right* bit is flipped (e.g. 01 becomes 00). After the register has been manipulated in this fashion, the *left* bit is observed. Suppose that on the first three time steps, we observe 0, 0, 1. **(35)**

   (a) Show how the register can be formulated as an HMM. What is the probability of transitioning from every state to every other state? What is the probability of observing each output (0 or 1) in each state?

   (b) Use the filtering algorithm to determine the probability of being in each state at time *t* after observing only the first t bits, for t=1,2,3.

Contd P/2

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Contd ... Q. No. 2

(c) Use the forward-backward algorithm to determine the probability of being in each state at time k given all three observed bits, for k=0,1,2,3.

(d) What is the most likely sequence of states given all three observed bits? (Be sure to include the initial state at time 0 in your sequence.)

3. (a) You want to design your own ranking function to re-rank the Google provided search results. How do you update your weights for the Perceptron based ranking function? **(10)**

(b) How does bag-of-words model of Naïve Bayes classifier work for spam/non-spam classification, and how do you handle words with zero probabilities? **(5+5)**

(c) What's D-separation rule of conditional independence? How do you determine whether a path is active or not? **(8+7)**

4. (a)

	O	T	H	W	Play?
1	S	H	H	W	-
2	S	H	H	S	-
3	O	H	H	W	+
4	R	M	H	W	+
5	R	C	N	W	+
6	R	C	N	S	-
7	O	C	N	S	+
8	S	M	H	W	-
9	S	C	N	W	+
10	R	M	N	W	+
11	S	M	N	S	+
12	O	M	H	S	+
13	O	H	N	W	+
14	R	M	H	S	+

Consider the above dataset of 14 examples. In this example, we have four input attributes representing four columns O, T, H, and W to mean the following: **(20)**

Outlook: S(unny), O(vercast), R(ainy)

Temperature: H(ot), M(edium), C(ool)

Humidity: H(igh),N(ormal), L(ow)

Wind: S(trong), W(eak)

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Contd ... Q. No. 4(a)

Based on the values of different attributes, you will decide whether one should play (Yes (+) /No (-)) the basketball. In the above examples, real outcomes of 14 instances for Play is labeled as + or – in the rightmost column. Now you need to build a decision tree based on the concept of information gain, where four columns O, T, H, and W are input variables and the Play column is considered as output. Show the calculation at each step of the tree construction.

(b) How does nearest neighbor based classifier work? **(10)**

(c) What is the concept of deep-learning based image classification? **(5)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) Briefly describe the Turning Test. What advances do you think need to be made in order for the Turing Test to be passed? **(10)**

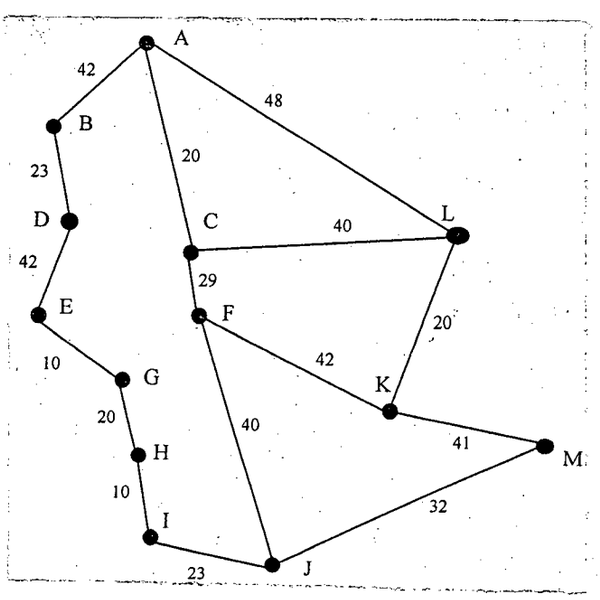
(b) What are the four approaches to AI? Briefly describe the rational agent approach to AI. How can you define rationality? What is a rational agent? Why should a rational agent be autonomous? **(16)**

(c) What is the PEAS description of a task environment? Provide two examples of agent types and their PEAS descriptions. **(9)**

6. (a) For the following map, using the A* algorithm, find a route from town A to town M. Show the search for your solution, showing the order in which the nodes were expanded and cost at each node. Assume previously visited states will not be re-visited. The Straight Line Distances between any town and town M are shown in the table below. Use it as a measure of the straight line distance heuristic. **(15)**

Straight Line Distance to M

A	51
B	50
C	32
D	28
E	42
F	14
G	33
H	43
I	50
J	32
K	41
L	56
M	0



Contd P/4

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Contd ... Q. No. 6

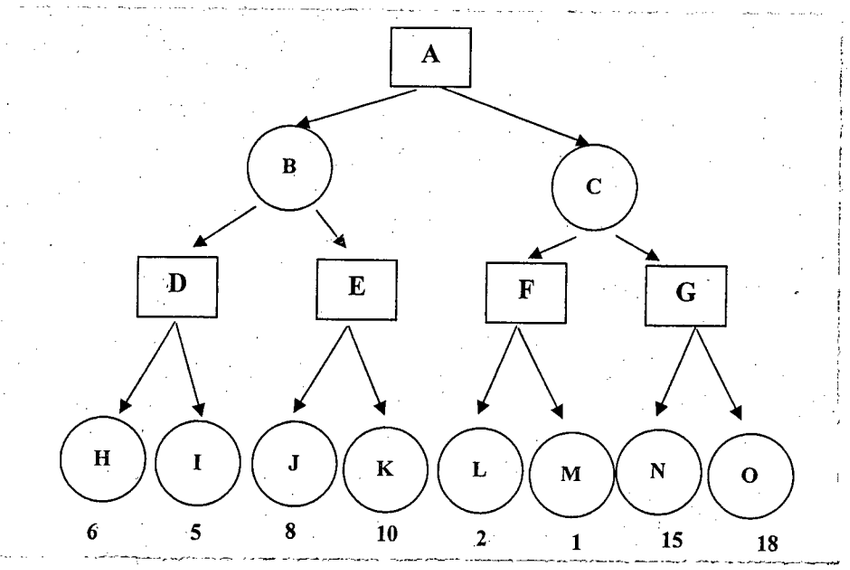
(b) State the conditions under which the optimality of the A* search algorithm is guaranteed. Briefly explain pruning and cost contours in the context of A* search done in Q. No. 6(a). **(10)**

(c) Find a route from town A to town M for the problem given in Q. No. 6(a) using the greedy best-first search algorithm. Is this solution optional? **(10)**

7. (a) How can a game be formally defined as a kind of search problem? Consider a two-player game with the rules given below. The game starts with a single stack of 5 tokens. At each move, a player selects one stack and divides it into two non-empty, non-equal stacks. A player who is unable to move loses the game. **(5+20)**

Assume two players, min and max, play it. Min plays first. If a terminal state in the search tree developed above is a win for min, a utility function of zero is assigned to that state. A utility function of 1 is assigned to a state if max wins the game. Draw the complete search tree. Apply the minimax algorithm to the search tree to assign utility functions to all states in the search tree. If both min and max play a perfect game, who will win? Explain your answer.

(b) Given the following search tree, apply the alpha-beta pruning algorithm and show the search tree that would be obtained. Make sure that you show where the cuts are applied and which parts of the search tree are pruned as a result. **(10)**



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8. (a) Describe the terms complete and optimal with regards to evaluating search strategies. Is either depth-first-search or breadth-first-search complete? Is either of them optimal? What is the worst-case time and space complexity of these two algorithms? **(10)**

   (b) How can you learn heuristics from experience? Provide an illustrative example for the sliding puzzle domain. What is a relaxed problem? **(10)**

   (c) Why does a hill-climbing search often fail to find the global optimal solution? What is the random-restart hill-climbing search? Briefly explain how you can perform hill-climbing search for the Traveling Salesman Problem (TSP) using both construction and improvement heuristics. **(15)**

L-4/T-1/CSE Date : 12/09/2018

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **IPE 493** (Industrial Management)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) With a flow diagram, show the basic cost classification of a manufacturing organization with examples. Show the product cost and period cost in the diagram. **(7)**

(b) A company manufactures basic cell phone, smart phone and tablet phone as a product mix. The yearly sales and expenses in 2017 are shown in the following table: **(18)**

	Basic cell phone	Smartphone	Tablet phone
Sales volume (units)	15,000	35,000	30,000
Selling price ($/ unit)	70	550	595
Variable expense ($/ unit)	45	460	510
Fixed expense ($)	1,000,000		

Find-

(i) What were the breakeven quantities of the product mix?

(ii) Calculate CM ratio and margin of safety of each product.

(iii) If the company wants to invest more on production of a particular product, which product it should select and why?

(iv) The company predicts that if it reduces the price of the tablet phone by $30, it will increase its sales by 8,000 units. But it will cause a decrease in sales of the smartphone by 2,000 units. The advertising cost will be increased by $20,000. Should the company take such a decision?

(v) According to the given data in the above table, if the company wants to earn a profit of $10,000,000 in 2018, what should be the sales volume of the product mix?

(c) What is 'Six Sigma Management'? What is the importance of implementing this concept in quality? Explain with an example. **(10)**

2. (a) Suppose, you are in charge of developing and managing a new software team as the team leader with newly appointed engineers at your organization. You are suggested to follow one of the contingency theories of leadership that would help you to manage the team in all the phase of team development. What type of leadership style are you going to follow and why? **(15)**

(b) How can conflict have positive impact on group performance? **(5)**

Contd P/2

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Contd ... Q. No. 2

(c) A company currently has 12 tasks to be accomplished for the assembly of an electronic product. Production runs 8 hours per day in the factory. The task times and the immediate predecessors of these tasks are shown in the following table: **(15)**

Task	Task Time (min)	Immediate Predecessor
A	2.4	-
B	4.6	A
C	1.0	B
D	1.2	C
E	0.5	D
F	0.5	D
G	0.8	E, F
H	1.2	C
I	1.5	H
J	1.0	G,I
K	1.0	J

The company identifies that the market demand of the product is 200 units per day and wants to improve the efficiency of the production line.

(i) Draw a precedence diagram.

(ii) Calculate desired cycle time.

(iii) Calculate theoretical minimum no. of workstations.

(iv) Assign task to the workstations.

(v) Calculate the efficiencies of the previous and the current assembly lines.

3. (a) Suppose, your organization has aimed to avoid recency error and biasness from performance appraisal procedure. Suggest an appraisal method (or a combination of appraisal methods) for this purpose and explain the reasons behind your suggestion. **(15)**

(b) Differentiate Rowan Plan from Halsey Plan. The standard task for a particular machining operation is 10 pcs/hr. Low task is 80% of the standard task and guaranteed base rate is 45 tk/hr. If the worker take 6 hours complete 80 pieces, find the wage for the job and rate of incentive per hour according to Rowan Plan. **(10)**

(c) How can you relate Maslow's need hierarchy with McGregor's theory X and theory Y? Explain. **(10)**

4. (a) A company wants to establish 6 manufacturing plants in different locations for the production of six different products. The estimated establishment cost of these plants are shown in the following table: **(15)**

Contd P/3

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Contd ... Q. No. 4(a)

	Location -1	Location -2	Location -3	Location -4	Location -5	Location -6
Plant-1	53	36	55	60	51	42
Plant-2	66	45	25	80	46	30
Plant-3	42	33	61	58	24	60
Plant-4	20	45	35	71	26	41
Plant-5	16	58	37	46	22	28
Plant-6	69	45	68	36	46	75

Make a decision for plant locations for the company.

(b) Explain the certification procedure of ISO9000 QMS. **(10)**

(c) How can you use Pareto Principle in ABC analysis? Give an example. **(5)**

(d) What is the function of activity relationship chart? Explain with example. **(5)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Explain how you can apply the management principles of Henry Fayol in today's context for successfully performing management functions. **(15)**

(b) "Different and changing situations require managers to use different approaches and techniques" – do you agree with this statement? Explain the management approach that is best suited to this statement. **(10)**

(c) Consider the following data- **(10)**

	Project A	Project B
Capital investment	$110,000	$135,000
Annual O&M cost	12,500	45,000
Annual benefit	37,500	80,000

With a study period of 20 years and MARR of 10% per year, calculate the conventional and modified B-C ratios. Explain which project is better. **(10)**

6. (a) Briefly explain the scopes of marketing. How can you increase the value of a product with respect to products entire life cycle? **(7+8)**

(b) Suppose, you have just become 20 years of age and started saving $1.00 each day for the rest of your life. At what percent nominal interest rate compounded semi-annually you will become millionaire assuming that you may live up to 60 years? What will be the effective interest rate? **(10)**

(c) Describe the two models of organizational design. Give suitable examples for each type. **(10)**

Contd P/4

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7. (a) On his way to office, Mr. X lost a file on which he performed some calculations on the feasibility of a possible project. He retrieved the following data from the office-

Year	Cash Flow (in thousand dollar
0	+2000
1	– 500
2	– 8100
3	+6800

He can vaguely remember that the IRR he calculated for this project is close to either 10% or 40%. However, after examining the data that he retrieved, he suspects that it might be *both*. Notice that at year 0, cash flow is positive. This is because of an advance payment from the customer.

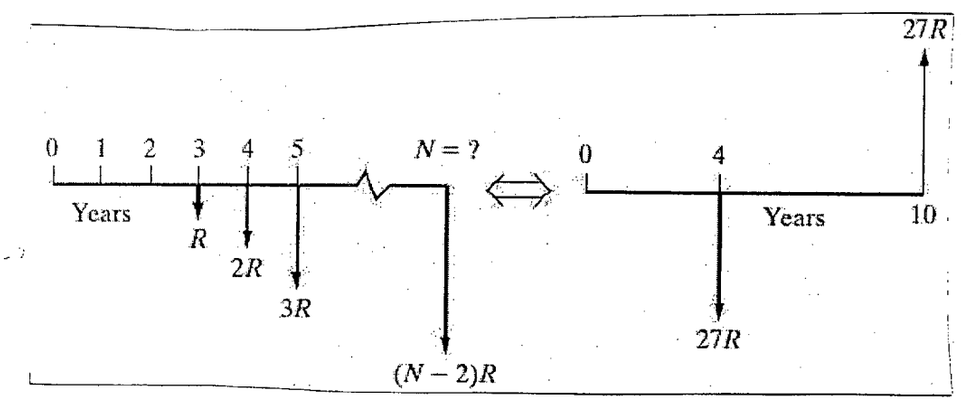
(i) Draw the cash flow diagram

(ii) How can you suspect that there might be multiple IRRs in this case? Perform the associated tests.

(iii) Calculate the IRR(s). The MARR is 9% per year.

Make a decision for the project using MIRR approach. The investment rate is 12% per year and the borrowing rate is 8.5% per year. **(15)**

(b) What value of N comes closest to making the left-hand cash-flow diagram of the accompanying figure equivalent to the one on the right? Let i = 15% per year. **(10)**



(c) Suppose, you are a CEO of a company. You have to recruit one-mid level and one front line manager. Which type of skill will you give more importance in each selection and why? Also, explain the case when you were recruited as company's CEO. **(10)**

8. (a) Draw $\overline{X}$ – S chart for the following data. State whether the process is within control or out of control with necessary justification. **(15)**

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Contd ... Q. No. 8(a)

Sample No.	Bore Diameters (mm)					$\overline{X}$ (mm)	S (mm)
1	9.9	10.18	10.16	10.16	9.93	10.066	0.1385
2	10.05	10.03	9.93	9.9	9.96	9.974	0.0643
3	10.03	10.11	10.18	9.96	10.16	10.088	0.092
4	10.01	9.93	9.86	9.9	9.93	9.926	0.055
5	10.11	10.15	10.05	9.87	9.86	10.008	0.1354
6	9.93	10.06	10.15	10.16	10.17	10.094	0.1016
7	9.86	9.96	9.9	10.11	10.03	9.972	0.1003
8	10.16	10.18	10.07	9.87	10.05	10.066	0.123
9	9.96	9.9	10.05	10.16	10.11	10.036	0.1064
10	10.19	10.11	10.16	10.05	9.96	10.094	0.0918
11	9.98	9.93	10.07	9.96	10.18	10.024	0.1016
12	9.89	9.87	9.95	9.93	10.15	9.958	0.1119
13	10.15	10.17	10.17	9.86	10.16	10.102	0.1355
14	10.17	9.86	10.18	10.18	10.05	10.088	0.1388
15	9.96	10.18	9.96	10.17	9.81	10.016	0.1576

Table B. Factors used in 3σ Quality Control Charts.

Sample size n	$\overline{X}$ charts			S charts					Factors for central line
	Factors for control limits			Factors for central line	Factors for control limits				
	A	A_2	A_3	c_4	B_3	B_4	B_5	B_6	d_2
2	2.121	1.880	2.659	0.7979	0	3.267	0	2.606	1.128
3	1.732	1.023	1.954	0.8862	0	2.568	0	2.276	1.693
4	1.500	0.729	1.628	0.9213	0	2.266	0	2.088	2.059
5	1.342	0.577	1.427	0.9400	0	2.089	0	1.964	2.326
6	1.225	0.483	1.287	0.9515	0.030	1.970	0.029	1.874	2.534
7	1.134	0.419	1.182	0.9594	0.118	1.882	0.113	1.806	2.704
8	1.061	0.373	1.099	0.9650	0.185	1.815	0.179	1.751	2.847
9	1.000	0.337	1.032	0.9693	0.239	1.761	0.232	1.707	2.970
10	0.949	0.308	0.975	0.9727	0.284	1.716	0.276	1.669	3.078
11	0.905	0.285	0.927	0.9754	0.321	1.679	0.313	1.637	3.173
12	0.866	0.266	0.886	0.9776	0.354	1.646	0.346	1.610	3.258
13	0.832	0.249	0.850	0.9794	0.382	1.618	0.374	1.585	3.336
14	0.802	0.235	0.817	0.9810	0.406	1.594	0.399	1.563	3.407
15	0.775	0.223	0.789	0.9823	0.428	1.572	0.421	1.544	3.472
16	0.750	0.212	0.763	0.9835	0.448	1.552	0.440	1.526	3.532
17	0.728	0.203	0.739	0.9845	0.466	1.534	0.458	1.511	3.588
18	0.707	0.194	0.718	0.9854	0.482	1.518	0.475	1.496	3.640

(b) What do you understand by management of technology? Explain the importance of management of technology with relevant examples. **(15)**

(c) Differentiate between job enlargement and job enrichment. **(5)**

L-4/T-1/CSE **Date : 18/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **CSE 433** (Digital Image Processing)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Briefly describe Ideal high pass filter (IHPF), Butterworth high pass filter (BHPF) and Gaussian high pass filter (GHPF). Explain cut off frequency with necessary mathematical expression. **(15)**

   (b) What is approximation pyramid and prediction residual pyramid? Describe the steps to build prediction residual pyramid. **(8)**

   (c) A sequence of 20 still images of a moving vehicle generates the spectrum for $G_y(u_2, a_2)$ with the first peak at $u_2 = 10$, $a_2 = 3$. The frame rate of the sequence is 30 frames/second and the distance between two pixels is equivalent to 0.4 meters. Find the speed of the vehicle. **(7)**

   (d) Decode the BMP encoded sequence {3, 4, 5, 6, 0, 3, 103, 125, 67, 2, 47}. You do not need to write any explanation. **(5)**

2. (a) Explain the imaging mechanism used in CAT scanner with appropriate figure. **(10)**

   (b) Write down the filtering steps in frequency domain in details. **(10)**

   (c) What is the blocking artifact in image compression? Compare the performances of DFT(Discrete Fourier Transformation) DCT (Discrete Cosine Transformation) and WHT (WalshHadamart Transformation). **(8)**

   (d) Let us consider that we have an 8 bit image of size M×N. We wish to apply 2-D DFT Discrete Fourier Transformation) on the image and want to view F(0, 0) at (M/4, N/2). How can we achieve this? Provide necessary mathematical explanations. **(7)**

3. (a) Given the normalization matrix in figure 3(i), find the JPEG compressed representation of pixel (0, 0), (0, 1) and (2, 3) of the 8 × 8 image block whose DCT coefficients are given in figure 3(ii). **You need to write down the whole zigzag pattern but calculate only the pixels mentioned above**. Assume DC coefficient of the previous image block is –17. Use the tables 3(iii-v) attached to the question paper. **(20)**

Contd P/2

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Contd ... Q. No. 3(a)

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Figure 3(i)

-336	**35**	82	3	5	8	10	12
2	2	3	4	29	12	12	11
3	3	3	**26**	8	11	14	11
3	3	4	6	10	17	16	12
4	4	7	11	14	22	21	15
5	7	11	13	16	21	23	18
10	13	16	17	21	24	24	20
14	18	19	20	22	20	21	20

Figure 3(ii)

(b) The LZW encoded value of an image is {55, 55, 168, 70, 170, 259, 261, 262, 256}. Decode this encoded output appropriately. **(10)**

(c) What is Haar transform? Write the H_2 and H_4 matrix in context of Haar transform. **(5)**

4. (a) The arithmetic decoding process is the reverse of the encoding procedure. Decode the message 0.23355 having length 4 given the following coding model -- **(10)**

Symbol	Probability
e	0.2
h	0.3
y	0.1
g	0.2
w	0.1
a	0.1

(b) Why threshold coding performs better than zonal coding in DCT (discrete cosine transformation) based image compression? **(8)**

(c) Consider a checkerboard image in which each square is 1×1 mm. Assuming that the image extends infinitely in both coordinate directions, what is the minimum sampling rate (in samples/mm) required to avoid aliasing? **(6)**

(d) Write down the equations of Ideal bandreject filter, Butterworth bandreject filter and Gaussian bandreject filter. **(6)**

(e) "Huffman coding performs exceptionally well on a histogram equalized image" – do you agree with this statement? Justify your answer. **(5)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) Intensity-slicing (also known as bit plane-slicing) transformations find contribution of individual bits of the pixels of grayscale images. Thresholding can be used to do the same task. Write necessary thresolding equations to find all bit planes of an 8-bit grayscale

Contd P/3

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Contd ... Q. No. 5(a)

image. Explain why gray code is preferable to binary code while computing bit planes of an image. **(24+3=27)**

(b) You are hired to design an image de-noising model using arithmetic operation to remove noises from images that are corrupted with uncorrelated and zero-mean noises while being transmitted from a remote source. With necessary mathematical equations, explain how a de-noised image approaches to its original transmitted copy. **(8)**

6. (a) With necessary examples, show that the median filter is a non-linear filter. Why does a median filter remove only those dark or light noises whose area is less than one-half the area of the filter? **(10+8=18)**

(b) You are asked to find circular shapes in a binary image. Design a procedure based on Hough transform. Identify the difference between your procedure and the procedure that detects collinear points based on slope-intercept method. What will be the ranges of values of the constants used in your procedure? **(10+7=17)**

7. (a) Suppose you are lucky enough to model the normalized histogram of an image, *I*, using the following Gaussian distribution:

$$p_r(r) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r-m)^2}{2\sigma^2}}$$

where, *r* is input gray scale value, m and σ are mean and standard deviation of gray scale values of *I*. Analytically show that you can find a histogram equalized image of *I*. Let the equalized image be *J*. With necessary mathematical equations, justify what will happen if you apply histogram equalization again on *J*. **(13+12=25)**

(b) The Laplacian operator (second order derivative) has two different implementations: one with a –4 in the center and the other with a –8 in the center. Explain why the later one is more suitable for point detection than the former one. **(10)**

8. (a) Explain a medical application that uses arithmetic operation on images. What problem does this operation result? What could happen if this issue is not properly addressed? How is this issue addressed? **(6+3+3+5=17)**

(b) Prove that the sum of the elements of a convolution array (know as output image filtered by a convolution mask) is proportional to the sum of the mask elements. (*Hints: start with the convolution formula*). Now write down the digital implementation (the matrix) of Laplacian of Gaussian (LoG) operator and show that the sum of the elements of an output image filtered by the LoG operator is zero. **(10+8=18)**

Contd P/4

Table 3(iii) : JPEG Coefficient Coding Categories

Range	DC Difference Category	AC Category
0	0	N/A
−1, 1	1	1
−3, −2, 2, 3	2	2
−7, . . . , −4, 4, . . . , 7	3	3
−15, . . . , −8, 8, . . . , 15	4	4
−31, . . . , −16, 16, . . . , 31	5	5
−63, . . . , −32, 32, . . . , 63	6	6
−127, . . . , −64, 64, . . . , 127	7	7
−255, . . . , −128, 128, . . . , 255	8	8
−511, . . . , −256, 256, . . . , 511	9	9
−1023, . . . , −512, 512, . . . , 1023	A	A
−2047, . . . , −1024, 1024, . . . , 2047	B	B
−4095, . . . , −2048, 2048, . . . , 4095	C	C
−8191, . . . , −4096, 4096, . . . , 8191	D	D
−16383, . . . , −8192, 8192, . . . , 16383	E	E
−32767, . . . , −16384, 16384, ... 32767	F	N/A

Table (iv) : JPEG default DC code

Category	Base Code	Length	Category	Base Code	Length
0	010	3	6	1110	10
1	011	4	7	11110	12
2	100	5	8	111110	14
3	00	5	9	1111110	16
4	101	7	A	11111110	18
5	110	8	B	111111110	20

Contd..... P/5

Table (v) : JPEG default AC code (Continuous on next page)

Run/ Category	Base Code	Length	Run/ Category	Base Code	Length
0/0	1010 (= EOB)	4			
0/1	00	3	8/1	11111010	9
0/2	01	4	8/2	111111111000000	17
0/3	100	6	8/3	1111111110110111	19
0/4	1011	8	8/4	1111111110111000	20
0/5	11010	10	8/5	1111111110111001	21
0/6	111000	12	8/6	1111111110111010	22
0/7	1111000	14	8/7	1111111110111011	23
0/8	1111110110	18	8/8	1111111110111100	24
0/9	1111111110000010	25	8/9	1111111110111101	25
0/A	1111111110000011	26	8/A	1111111110111110	26
1/1	1100	5	9/1	111111000	10
1/2	111001	8	9/2	1111111110111111	18
1/3	1111001	10	9/3	1111111111000000	19
1/4	111110110	13	9/4	1111111111000001	20
1/5	11111110110	16	9/5	1111111111000010	21
1/6	1111111110000100	22	9/6	1111111111000011	22
1/7	1111111110000101	23	9/7	1111111111000100	23
1/8	1111111110000110	24	9/8	1111111111000101	24
1/9	1111111110000111	25	9/9	1111111111000110	25
1/A	1111111110001000	26	9/A	1111111111000111	26
2/1	11011	6	A/1	111111001	10
2/2	11111000	10	A/2	1111111111001000	18
2/3	1111110111	13	A/3	1111111111001001	19
2/4	1111111110001001	20	A/4	1111111111001010	20
2/5	1111111110001010	21	A/5	1111111111001011	21
2/6	1111111110001011	22	A/6	1111111111001100	22
2/7	1111111110001100	23	A/7	1111111111001101	23
2/8	1111111110001101	24	A/8	1111111111001110	24
2/9	1111111110001110	25	A/9	1111111111001111	25
2/A	1111111110001111	26	A/A	1111111111010000	26
3/1	111010	7	B/1	111111010	10
3/2	111110111	11	B/2	1111111111010001	18
3/3	11111110111	14	B/3	1111111111010010	19
3/4	1111111110010000	20	B/4	1111111111010011	20
3/5	1111111110010001	21	B/5	1111111111010100	21
3/6	1111111110010010	22	B/6	1111111111010101	22
3/7	1111111110010011	23	B/7	1111111111010110	23

Contd P/6

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Run/ Category	Base Code	Length	Run/ Category	Base Code	Length
3/8	1111111110010100	24	B/8	1111111111010111	24
3/9	1111111110010101	25	B/9	1111111111011000	25
3/A	1111111110010110	26	B/A	1111111111011001	26
4/1	111011	7	C/1	1111111010	11
4/2	1111111000	12	C/2	1111111111011010	18
4/3	1111111110010111	19	C/3	1111111111011011	19
4/4	1111111110011000	20	C/4	1111111111011100	20
4/5	1111111110011001	21	C/5	1111111111011101	21
4/6	1111111110011010	22	C/6	1111111111011110	22
4/7	1111111110011011	23	C/7	1111111111011111	23
4/8	1111111110011100	24	C/8	1111111111100000	24
4/9	1111111110011101	25	C/9	1111111111100001	25
4/A	1111111110011110	26	C/A	1111111111100010	26
5/1	1111010	8	D/1	11111111010	12
5/2	1111111001	12	D/2	1111111111100011	18
5/3	1111111110011111	19	D/3	1111111111100100	19
5/4	1111111110100000	20	D/4	1111111111100101	20
5/5	1111111110100001	21	D/5	1111111111100110	21
5/6	1111111110100010	22	D/6	1111111111100111	22
5/7	1111111110100011	23	D/7	1111111111101000	23
5/8	1111111110100100	24	D/8	1111111111101001	24
5/9	1111111110100101	25	D/9	1111111111101010	25
5/A	1111111110100110	26	D/A	1111111111101011	26
6/1	1111011	8	E/1	11111110110	13
6/2	11111111000	13	E/2	1111111111101100	18
6/3	1111111110100111	19	E/3	1111111111101101	19
6/4	1111111110101000	20	E/4	1111111111101110	20
6/5	1111111110101001	21	E/5	1111111111101111	21
6/6	1111111110101010	22	E/6	1111111111110000	22
6/7	1111111110101011	23	E/7	1111111111110001	23
6/8	1111111110101100	24	E/8	1111111111110010	24
6/9	1111111110101101	25	E/9	1111111111110011	25
6/A	1111111110101110	26	E/A	1111111111110100	26
7/1	11111001	9	F/0	11111110111	12
7/2	11111111001	13	F/1	1111111111110101	17
7/3	1111111110101111	19	F/2	1111111111110110	18
7/4	1111111110110000	20	F/3	1111111111110111	19
7/5	1111111110110001	21	F/4	1111111111111000	20
7/6	1111111110110010	22	F/5	1111111111111001	21
7/7	1111111110110011	23	F/6	1111111111111010	22
7/8	1111111110110100	24	F/7	1111111111111011	23
7/9	1111111110110101	25	F/8	1111111111111100	24
7/A	1111111110110110	26	F/9	1111111111111101	25
			F/A	1111111111111110	26

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **CSE 411** (Simulation and Modeling)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) You assume that the average salary of a graduate is 32000 Taka. But you have the fear that the actual average salary can be less than that. So, you ask some passed graduates and get the following observations (in Taka). 25000, 15000, 35000, 31000, 29000 and 20000 Now, declare the null hypothesis and alternative hypothesis for your experiment. With 0.95 confidence, decide whether you should reject the null hypothesis or not. See the table of Figure 1(a) for the required t-table. **(10)**

   (b) Suppose that X and Y are jointly continuous random variables with

$$f(x,y)=\begin{cases}20xy, & for\ x\geq 0, y\geq 0, \text{and}\ x+y\leq 1\\ 0, & \text{otherwise}\end{cases}$$

   Analyzing their covariance value, determine whether the variables are independent or not. Briefly explain the reason behind your answer. Note that, the formula to determine the covariance of two random variables A and B is $Cov(A, B) = E(AB) - E(A)E(B)$ **(10)**

   (c) How Inverse-Transform method can be used for a mixed distribution (containing both continuous and discrete pert) having flat spots. **(8)**

   (d) Make a comparative analysis between normal distribution and t distribution in case of constructing confidence intervals. **(7)**

2. (a) What was the Marsaglia's observation regarding random numbers generated by Linear Congruential Generators (LCGs)? How did it lead to spectral test? Briefly discuss about spectral test. **(3+4+6=13)**

   (b) Briefly describe the composite generator using shuffling method with an example. What are Prime Modulus Multiplicative Linear Congruential Generators (PMMLCGs)? **(8+4=12)**

   (c) Suppose, you want to test the quality of a random number generator through runs-up test. For this reason, you collect some random numbers generated by this generator. The numbers are 0.86, 0.11, 0.23, 0.03, 0.13, 0.06, 0.55, 0.64, 0. 60 and 0.10. If the rejection point value of chi-square distribution for this case, $\chi^2_{6,0.90} = 10.6$, then decide whether you should reject the hypothesis of independence of the generated data by this generator at significance level $\alpha = 0.10$. For your convenience, the a_{ij} matrix and the b_i vector are given in Figure 2(c). **(10)**

Contd P/2

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Contd ... Q. No. 2(c)

$$\begin{bmatrix} 4,529.4 & 9,044.9 & 13,568 & 18,091 & 22,615 & 27,892 \\ 9,044.9 & 18,097 & 27,139 & 36,187 & 45,234 & 55,789 \\ 13,568 & 27,139 & 40,721 & 54,281 & 67,852 & 83,685 \\ 18,091 & 36,187 & 54,281 & 72,414 & 90,470 & 111,580 \\ 22,615 & 45,234 & 67,852 & 90,470 & 113,262 & 139,476 \\ 27,892 & 55,789 & 83,685 & 111,580 & 139,476 & 172,860 \end{bmatrix}$$

a_{ij} matrix (upper left element is the first element)

$$(b_1, b_2, \ldots, b_6) = \left(\frac{1}{6}, \frac{5}{24}, \frac{11}{120}, \frac{19}{720}, \frac{29}{5040}, \frac{1}{840}\right)$$

b_i vector

Figure 2(c)

3. (a) Consider a random variable having the following density function (also plotted in Figure 3(a)).

$$f(x) = \begin{cases} x^2, & if\, 0 \le x \le 1 \\ (2-x)^2, & if\, 1 < x \le 2 \\ 0, & otherwise \end{cases}$$

Derive an acceptance-rejection method to generate a random variate using this random variable. You **cannot** use any majorizing function in the form of $t(x) = c$, $0 \le x \le 2$. You should also discuss how you would generate random variables having density $r(x) = t(x)/c$. How many $U(0,1)$ random numbers you need, on an average, to generate each variate using your approach? **(17)**

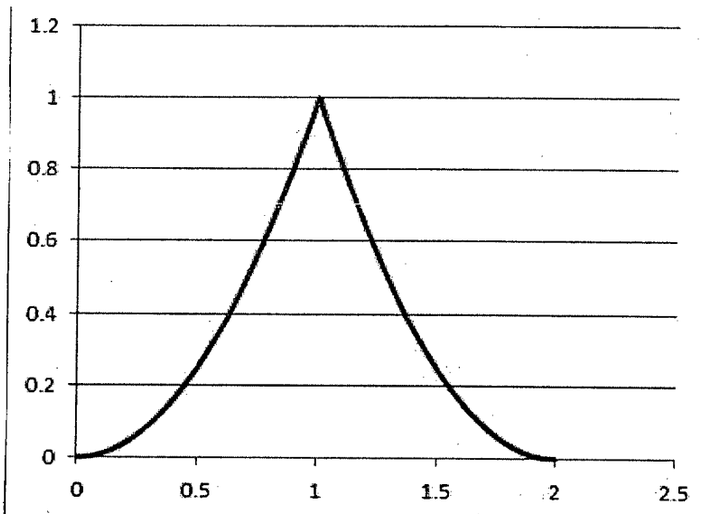

Figure 3(a): Plotted Density Function of Question 3(a)

(b) What are the conditions for a discrete-time stochastic process to be covariance-stationary? Briefly discuss about the warm-up period of a covariance-stationary process. **(6+4=10)**

(c) Consider following different probable values along with their probability for an arbitrary discrete distribution.

$p(1) = 0.123$, $p(2) = 0.401$, $p(3) = 0.156$ and $p(4) = 0.32$

Contd P/3

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Contd ... Q. No. 3(c)

Briefly explain how Marsaglia's method can be used to generate a random variate from this distribution. **(8)**

4. (a) Briefly explain the following two types of simulation along with **an example scenario for each.** **(6.5+6.5=13)**

   (i) Nonterminating simulation with steady-state parameters

   (ii) Nonterminating simulation with steady-state cycle parameters

   (b) Describe a composition algorithm for generating random variates for the density function shown in Figure 4(b). **(12)**

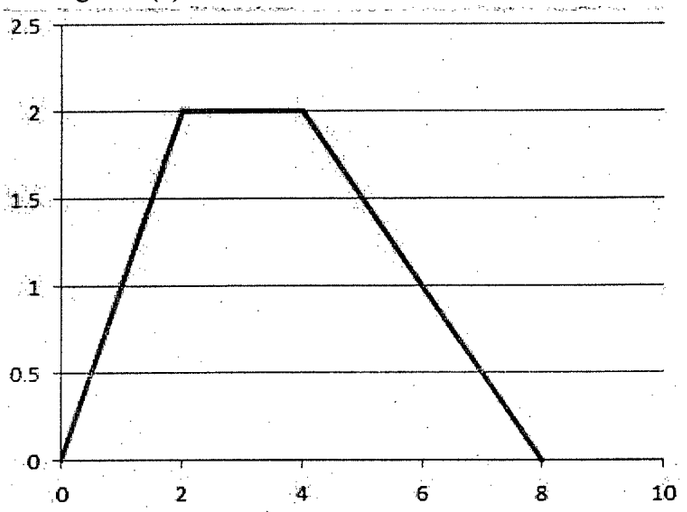

Figure 4(b): Density Function (The straight line of the middle part runs from (2,2) to (4,2))

   (c) Why Tausworthe Random Number Generator is called Linear Feedback Shift Register (LFSR)? **(5)**

   (d) Why is serial test important although there is chi-square test? **(5)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) When simulating any system, *some* distribution is directly used for random number generation. These random numbers are used in simulation and play a crucial role in finding the output from the simulation. Therefore, determining the most appropriate probability distribution and specifying that into the simulation software is also a crucial point for simulating a system. Hence, choosing an appropriate distribution is not trivial and must make use of the data observed from an existing system (which we are trying to simulate). Now, describe **three** ways to specify a probability distribution for a simulation software when you have collected real-life data from an existing system. **(10)**

   (b) Following is a box plot for an unknown distribution. **(10)**

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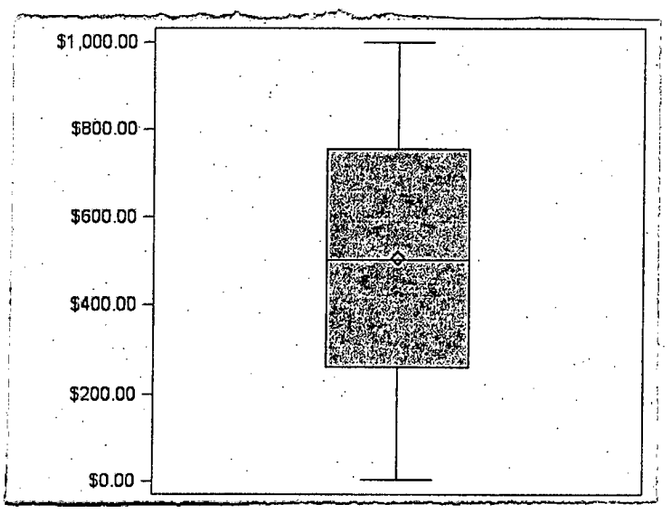
Contd ... Q. No. 5(b)



Since we do not have the actual data (from which the box plot was drawn), we cannot say much about the original distribution. However, we can still make good guess about the underlying distribution. Make your own justified guess and write proper justifications.

(c) Write *sample estimation formulas* (formulas that work when we have a number of observations at our disposal) for the following statistics. **(10)**

(i) Lexis ratio

(ii) Skewness.

Also, mention how Lexis ratio can help us distinguish between Poisson, binomial and negative binomial distributions.

(d) Why is it suggested to pick the intervals of Chi-square test to be equal? Briefly explain with proper mathematical reasoning. **(5)**

6. (a) The following data shown in Table 1 was fitted to the geometric distribution ***geom*(0.346)**. Perform a Chi-square test on this data. Divide the intervals of the Chi-square test so that each interval is expected to get around 50 samples. Perform the test upto the determination of χ^2. You do not have to compare the value of χ^2 with any reference value. **(15)**

Table 1				
Values and counts for n = 156 demand sizes arranged into increasing order				
0(59)	1(26)	2(24)	3(18)	4(12)
5(5)	6(4)	7(3)	9(3)	11(2)

[Note: 0(59) means out of the 156 observations, 59 of them were 0's.]

(b) Consider the *shifted* (***two-parameter***) *exponential distribution,* which has density:

$$f(x)=\begin{cases}\frac{1}{\beta}e^{-(x-\gamma)/\beta} & \text{if } x \geq \gamma \\ 0 & \text{otherwise}\end{cases}$$

For $\beta > 0$ and any real number γ. Note that, β is the shape parameter, and γ is the location

Contd P/5

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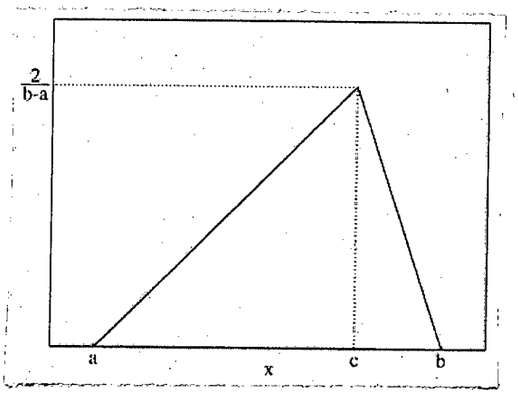
Contd ... Q. No. 6(b)

parameter. Given sample $X_1, X_2, X_3, \ldots X_n$ of IID random values from this distribution, find formulas for the joint MLEs $\hat{\gamma}$ and $\hat{\beta}$. **(15)**

(c) Triangular distribution, ***trang*(*a*, *b*, *c*)** has the following density shape. **(5)**



Discuss how you can determine MLE for this distribution.

7. (a) Consider the following *Pareto distribution* density, which can be abbreviated as Pareto (c, α_2).

$$f(x) = \alpha_2 x^{-(\alpha_2+1)} c^{\alpha_2} \text{ for } x > c$$

Show that $X \sim$ Pareto(c, α_2) if and only if $Y = \ln X \sim$ expo(ln c, $1/\alpha_2$), an exponential distribution with location parameter ln c and scale parameter $1/\alpha_2$. [Note that the *two parameter exponential distribution* density has already been described in Question 6(c).] **(15)**

(b) What are the three conditions that must hold for an LCG (*a Linear Congruential Random-number Generator*) to have a full period? **(5)**

(c) Without actually computing the Z_i's, determine which of the following mixed LCGs have a full period. **(15)**

(i) $Z_i = (13\ Z_{i-1}+13)(mod\ 16)$

(ii) $Z_i = (12\ Z_{i-1}+13)(mod\ 16)$

(iii) $Z_i = (13\ Z_{i-1}+12)(mod\ 16)$

8. (a) For a < b, the *right-triangular distribution* has density function

$$f_R(x) = \begin{cases} \dfrac{2(x-a)}{(b-a)^2} & if\ a \le x \le b \\ 0 & otherwise \end{cases}$$

And the *left-triangular distribution* has density function

$$f_L(x) = \begin{cases} \dfrac{2(b-x)}{(b-a)^2} & if\ a \le x \le b \\ 0 & otherwise \end{cases}$$

Let these distributions be denoted by $RT(a,b)$ and $LT(a,b)$, respectively. **(10+5+10=25)**

Contd P/6

CSE 411

Contd ... Q. No. 8(a)

(i) Derive the inverse-transform algorithm for generating random variates from $RT(0,1)$. Let this be called Algorithm 1.

(ii) Show that if $X \sim RT(0,1)$, then $1 - X \sim LT(0,1)$. Using this and Algorithm 1, derive an algorithm to generate random variates from $LT(0,1)$. Let this be called Algorithm 2.

(iii) Show that if $X \sim LT(0,1)$, then $X' = a + (b - a)X \sim LT(a,b)$. Using this and Algorithm 2, derive an algorithm to generate random variates from $LT(a,b)$.

(b) Derive an acceptance-rejection algorithm to generate random variates from the following density: **(10)**

$$f(x) = \begin{cases} \frac{3}{2}x^2 & if\ -1 \le x \le 1 \\ 0 & otherwise \end{cases}$$

Critical points $t_{\nu,\gamma}$ for the t distribution with ν df, and z_γ for the standard normal distribution
$\gamma = P(T_\nu \le t_{\nu,\gamma})$, where T_ν is a random variable having the t distribution with ν df; the last row, where $\nu = \infty$, gives the normal critical points satisfying $\gamma = P(Z \le z_\gamma)$, where Z is a standard normal random variable

	γ														
ν	0.6000	0.7000	0.8000	0.9000	0.9333	0.9500	0.9600	0.9667	0.9750	0.9880	0.9833	0.9875	0.9900	0.9917	0.9938
1	0.325	0.727	1.376	3.078	4.702	6.314	7.916	9.524	12.706	15.895	19.043	25.452	31.821	38.342	51.334
2	0.289	0.617	1.061	1.886	2.456	2.920	3.320	3.679	4.303	4.849	5.334	6.205	6.965	7.665	8.897
3	0.277	0.584	0.978	1.638	2.045	2.353	2.605	2.823	3.182	3.482	3.738	4.177	4.541	4.864	5.408
4	0.271	0.569	0.941	1.533	1.879	2.132	2.333	2.502	2.776	2.999	3.184	3.495	3.747	3.966	4.325
5	0.267	0.559	0.920	1.476	1.790	2.015	2.191	2.337	2.571	2.757	2.910	3.163	3.365	3.538	3.818
6	0.265	0.553	0.906	1.440	1.735	1.943	2.104	2.237	2.447	2.612	2.748	2.969	3.143	3.291	3.528
7	0.263	0.549	0.896	1.415	1.698	1.895	2.046	2.170	2.365	2.517	2.640	2.841	2.998	3.130	3.341
8	0.262	0.546	0.889	1.397	1.670	1.860	2.004	2.122	2.306	2.449	2.565	2.752	2.896	3.018	3.211
9	0.261	0.543	0.883	1.383	1.650	1.833	1.973	2.086	2.262	2.398	2.508	2.685	2.821	2.936	3.116
10	0.260	0.542	0.879	1.372	1.634	1.812	1.948	2.058	2.228	2.359	2.465	2.634	2.764	2.872	3.043
11	0.260	0.540	0.876	1.363	1.621	1.796	1.928	2.036	2.201	2.328	2.430	2.593	2.718	2.822	2.985
12	0.259	0.539	0.873	1.356	1.610	1.782	1.912	2.017	2.179	2.303	2.402	2.560	2.681	2.782	2.939
13	0.259	0.538	0.870	1.350	1.601	1.771	1.899	2.002	2.160	2.282	2.379	2.533	2.650	2.748	2.900
14	0.258	0.537	0.868	1.345	1.593	1.761	1.887	1.989	2.145	2.264	2.359	2.510	2.624	2.720	2.868
15	0.258	0.536	0.866	1.341	1.587	1.753	1.878	1.978	2.131	2.249	2.342	2.490	2.602	2.696	2.841
16	0.258	0.535	0.865	1.337	1.581	1.746	1.869	1.968	2.120	2.235	2.327	2.473	2.583	2.675	2.817
17	0.257	0.534	0.863	1.333	1.576	1.740	1.862	1.960	2.110	2.224	2.315	2.458	2.567	2.657	2.796
18	0.257	0.534	0.862	1.330	1.572	1.734	1.855	1.953	2.101	2.214	2.303	2.445	2.552	2.641	2.778
19	0.257	0.533	0.861	1.328	1.568	1.729	1.850	1.946	2.093	2.205	2.293	2.433	2.539	2.627	2.762
20	0.257	0.533	0.860	1.325	1.564	1.725	1.844	1.940	2.086	2.197	2.285	2.423	2.528	2.614	2.748
21	0.257	0.532	0.859	1.323	1.561	1.721	1.840	1.935	2.080	2.189	2.277	2.414	2.518	2.603	2.735
22	0.256	0.532	0.858	1.321	1.558	1.717	1.835	1.930	2.074	2.183	2.269	2.405	2.508	2.593	2.724
23	0.256	0.532	0.858	1.319	1.556	1.714	1.832	1.926	2.069	2.177	2.263	2.398	2.500	2.584	2.713

Figure 1(a): t-table for Question 1(a)

L-4/T-1/CSE **Date : 18/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **CSE 421** (Basic Graph Theory)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) What is the center of a tree. Show that the center of a tree is a vertex or an edge. **(3+7)**

   (b) When do we call a tree a caterpillar? Compute a graceful labeling of the caterpillar in Fig. 1. **(2+5)**

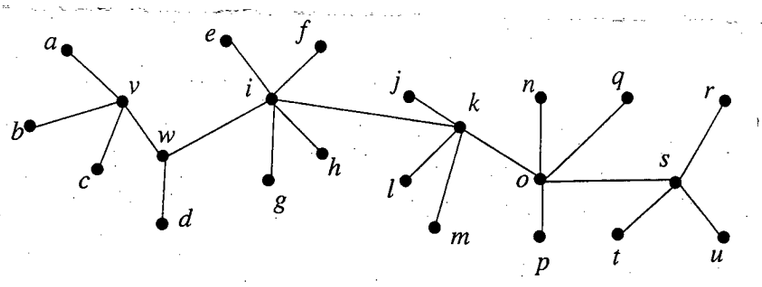


Figure 1: The tree for Question Number 1(b).

   (c) Construct the Prüffer's code for the tree in Fig. 2 showing every step. **(10)**

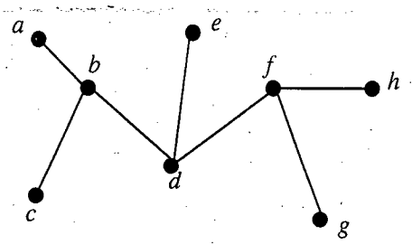


Figure 2: The tree for Question Number 1(c).

   (d) What is a simplicial vertex in a chordal graph? Construct a perfect elimination scheme of the chordal graph in Fig. 3 **(2+6)**

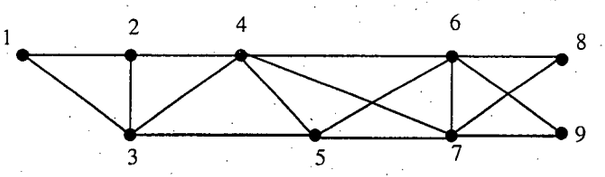


Figure 3: The graph for Question Number 1(d).

2. (a) Define the chromatic number and the chromatic index of a graph. Obtain chromatic numbers of P_5, W_5, K_5 and $K_{2,3}$. **(4+8)**

   (b) Show that every simple planer graph is 5-colorable. **(10)**

   (c) Draw three orientations of K_5. Show that every tournament T contains a Hamiltonian cycle. **(3+10)**

3. (a) Establish a relationship between the diameter and the domination number of a graph. **(5)**

Contd P/2

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Contd ... Q. No. 3

(b) Show that the number of separating triangles in a triangulated plane graph of n vertices is at most $n - 4$. **(10)**

(c) Show that a matching M in a graph G is a maximum matching if and only if G has no M-augmenting path. **(15)**

(d) Define a tree decomposition of a graph with an illustrative example. Explain the importance of treewidth of a graph from algorithmic point of view. **(3+2)**

4. (a) Write Kuratowski's theorem for planar graphs. Using Kuratowski's theorem show that Petersen graph in Fig. 4 is nonplanar. **(4+6)**

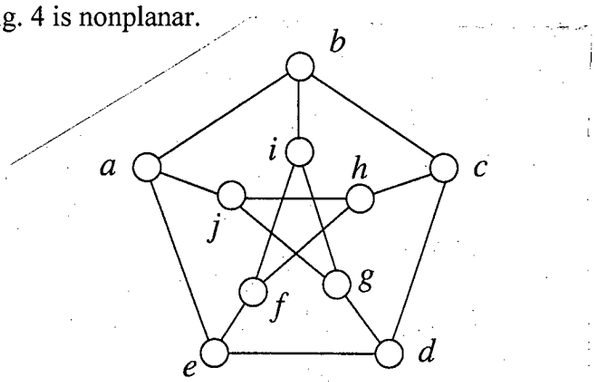

Figure 4: The graph for Question Number 4(a).

(b) Show that every maximal planar graph of four or more vertices has at least four vertices of degree five or less. **(8)**

(c) Prove that every simple planar graph has a straight line drawing. **(12)**

(d) Draw the dual of a plane embedding of K_4. Give an example of a self-dual graph of at least five vertices. **(2+3)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) There are five jobs $\{J_1, J_2, J_3, J_4, J_5\}$ in a company for which there are five workers A, B, C, D and E to do those jobs. However, everybody does not have expertise to do every job. Their expertise are as follows: A = $\{ J_3, J_4, J_5\}$, B = $\{J_2, J_4\}$, C = $\{ J_1, J_3, J_5\}$, D = $\{ J_1, J_3\}$ and E = $\{ J_1, J_5\}$. Develop a graph model to represent the job expertise of the persons and find an assignment of jobs to the workers such that every worker can do a job. **(10)**

(b) What is a bipartite graph? Give an algorithm to detect a bipartite graph and analyze the time complexity of the algorithm. **(10)**

(c) Define the followings with illustrative examples. **(4+4=8)**

(i) Union of two graphs (ii) Contraction of an edge.

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Contd ... Q. No. 5

(d) What are the space requirements of adjacency list representation and incidence matrix representation? When will you prefer adjacency list representation to other representations? **(4+3=7)**

6. (a) Define "degree sequence" and "graphic sequence". Disprove the following statement by providing a counter-example. "If two graphs have the same degree sequence, then the graphs are isomorphic." **(15)**

(b) Let G be a simple connected graph. Then prove that, $k(G) \leq k'(G) \leq \delta(G)$ where $k(G)$, $k'(G)$, $\delta(G)$ represent the connectivity, the edge-connectivity and the minimum degree respectively. **(12)**

(c) Define the complement of a graph. Construct the complements of $K_{3,3}$, W_5 and C_5. **(2+6=8)**

7. (a) Let G be a simple graph with n vertices. Let u and v be two vertices in G such that $(u, v) \notin E(G)$ and $d_G(u) + d_G(v) \geq n$. Then prove that G is Hamiltonian if and only if $G + (u, v)$ is Hamiltonian. **(12)**

(b) Prove that, every u, v-walk contains a u, v-path. **(8)**

(c) Define the following with illustrative examples. **(4+4=8)**

(i) Separating sets

(ii) Block-cutvertex tree

(d) Show that every regular graph with an odd degree has an even number of vertices **(7)**

8. (a) Write an algorithm to find a Eulerian circuit in a Eulerian graph based on the fact that a connected graph is Eulerian if and only if every vertex of G has even degree. **(15)**

(b) Let G be a graph with n vertices. Then prove that, any two of the following three statements imply the third (and characterize a tree of n vertices). **(15)**

(i) G is connected.

(ii) G contains no cycle.

(iii) G has $n - 1$ edges.

(c) Prove that, every connected graph contains a spanning tree. **(5)**

L-4/T-1/CSE **Date : 24/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 411** (Business Law)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Differentiate between void, voidable, illegal, unenforceable and valid contract with example. **(5)**

   (b) "Purchase is a valid contract" do you agree? Explain by stating all the components of contracts. **(8 ⅓)**

   (c) A made flexi load to his mobile number by Tk. 500 but by mistake cash was refilled to B's mobile number. Can A get refund from B? **(5)**

   (d) A lost her parts and announced a gift for the finder of the parts. B found the parts but didn't know about the announcement. Can B claim the gift? **(5)**

2. (a) Differentiate between fraud and error with example. **(3 ⅓)**

   (b) You are offered a job for the post of Manager that requires you to confirm within a week! You have posted a letter to confirm but the letter reached to the employer on 8th day. Is it a contract? **(5)**

   (c) A contract to pay a sum of money to a witness who has received a subpoena to appear at the court. Is it valid? **(5)**

   (d) A minor sold land to Mr. X for Tk. 50 lacs. Later the minor filed a case to set aside the sale on the ground of minority. Can the minor get back the title of the land? **(5)**

   (e) a Threated to file a case against B if he didn't sell his land to B. B agreed to sell. Is it a valid agreement? **(5)**

3. (a) Differentiate between wagering agreement and contingent contract with example. **(8 ⅓)**

   (b) Mr. A sold a cow to Mr. B by stating that the cow gives milk of 4 liter per day. B found that the cow gives 3.5 liter milk per day. Was the contract valid? Explain. **(5)**

   (c) Mr. A has lost his mobile phone and announced to reward Tk. 1000 who will make him find it. Is it a contract? Explain. **(5)**

   (d) ABC Ltd. has given assurance to Mr. Y that it will compensate the loss of goods in the factory of Y if the goods are destroyed by fire. The goods were destroyed deliberately by fire by Mr. Y as the price of the goods was lower than the cost. Can Mr. Y claim his loss? **(5)**

Contd P/2

HUM 411(CSE)

4. (a) Differentiate between go slow and lay off. Explain different types of worker. **(6)**

   (b) What are the types of employee leave? Explain the provisions for each type of leave. **(6)**

   (c) State the provisions regarding working hour for employees as per labor law, 2006 **(6)**

   (d) State the provisions regarding the punishment for conviction and misconduct and the procedure for punishment. **(5 ⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) "A Company is a separate, legal entity" explain the statement by focusing on the case of Salomon Vs. Salomon & Co. **(8)**

   (b) Differentiate between sole-proprietorship, partnership and company. **(8)**

   (c) Suppose, you are going to form a public limited company. What are the steps you need to follow to form the company? **(7 ⅓)**

6. (a) Draft a specimen of Memorandum of Association by incorporating its six components. **(8)**

   (b) Discuss the four categories of preference share. Explain share issue at discount. **(8)**

   (c) Explain the procedure to sell share in the primary market and secondary market by a public limited company. **(7 ⅓)**

7. (a) Explain the appointment, removal and rotation of a director. **(8)**

   (b) What are the five components of financial statement? State the provisions regarding books of accounts. **(8)**

   (c) What are the qualifications of an auditor? State the provisions regarding appointment and removal of an auditor. **(7 ⅓)**

8. (a) Differentiate between minutes and resolution. Explain different types of resolution. **(8)**

   (b) ABC Ltd. commenced its business in January 1, 2014. It holds its statutory meeting at January 25, 2014. The statutory report was issued 14 days before the meeting. The company holds its first AGM on August 1, 2015. The next AGM was declared on august 1, 2016 but the meeting was adjourned and was held in January 1, 2017. The next meeting will be held on March 3, 2018.

   Requirement: find out the irregularities regarding the meeting of the company. **(7 ⅓)**

   (c) "Winding up precedes dissolution" do you agree? When a company will be liquidated by the order of the court? **(8)**

L-4/T-1/CSE **Date : 24/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 211** (Sociology)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) 'Sociology is the study of social relationship' – justify this statement on the basis of nature of sociology. **(10)**

   (b) Discuss the properties and objectives of interactionist theoretical perspective of sociology. **(13 ⅓)**

2. (a) What do you understand by deviance? Write the merits and demerits of deviant behavior. **(10)**

   (b) Critically explain E. Sutherland's cultural transmission theory of deviance. **(13 ⅓)**

3. (a) What is socialization? Explain primary socialization and re-socialization with examples. **(10)**

   (b) Explain H. M. Johnson's view of conditions of successful learning. **(13 ⅓)**

4. Write short notes on any three of the following: **(23 ⅓)**

   (a) Early development of sociology (b) Karl Marx's theory of class differences
   (c) Social mobility.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) With reference to India, describe some social effects that resulted from the Industrial Revolution. **(13 ⅓)**

   (b) Explain Weber's argument in 'The Protestant Ethic and the Spirit of Capitalism'. **(10)**

6. (a) In what ways is globalization just a friendlier term for neo-imperialism? **(13 ⅓)**

   (b) Critically describe the 'Malthusian Theory' of population. **(10)**

7. (a) In a capitalist society we find that " formal schooling open to the masses and viewed as a means of advancing the social order" – R. T. Schaefer. Discuss the statement. **(13 ⅓)**

   (b) Identify the causes and the effects of some crucial environmental pollution that usually happen in Bangladesh. **(10)**

8. Write short notes on any THREE of the followings: **(23 ⅓)**

   (a) Pull factors of migration (b) Infant mortality rate (IMR) (c) New urban sociology (d) Human ecology

L-4/T-1/CSE **Date : 24/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 213** (Government)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE.**

1. (a) The state is an association of associations – Discuss. How does the State differ from a society? **(11 ⅓)**

   (b) Define sovereignty? Explain the nature of sovereignty. **(12)**

2. (a) What is constitution? Distinguish between rigid and flexible constitutions? **(11 ⅓)**

   (b) Explain the factors of nationality. Is nationalism contradictory to internationalism? **(12)**

3. (a) Classify modern types of government with relevant examples. **(11 ⅓)**

   (b) Describe the functions of the Legislative in a modern state. **(12)**

4. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Political Executive (b) Independence of Judiciary (c) Mass Upsurge of 1969

   (d) Legal Rights

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) Discuss the major features of the constitution of the People's Republic of Bangladesh. **(11 ⅓)**

   (b) Define local government. Discuss the functions of the rural local government in Bangladesh. **(11)**

6. (a) Write an essay on the political system of USA. **(11 ⅓)**

   (b) Describe the external and internal determinants of Bangladesh foreign policy. **(12)**

7. (a) What is UNO? Discuss the major functions of the UNO. **(11 ⅓)**

   (b) Discuss the constraints of good governance in developing countries. **(12)**

8. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Bureaucracy (b) Role of opposition in parliament (c) Socialism (d) Democracy

L-4/T-1/CSE **Date : 30/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

Sub : **CSE 403** (Digital System Design)

Full Marks : 210 Time : 3 Hours

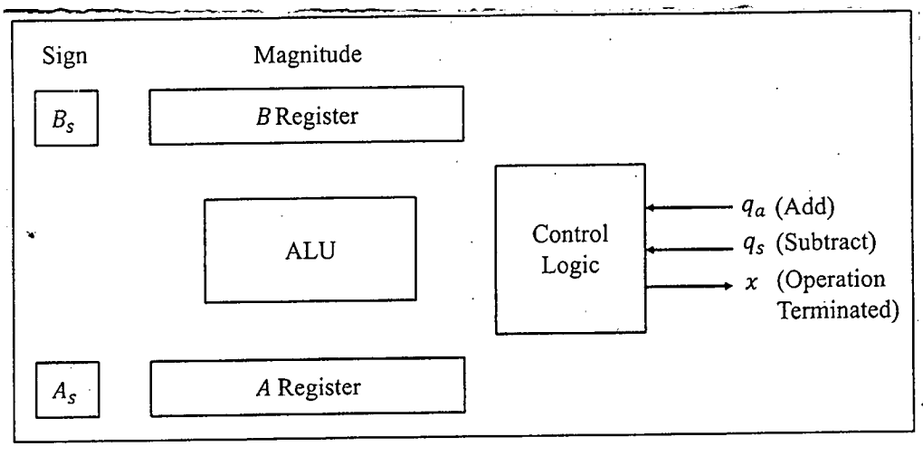
The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Suppose you have to design an adder-subtractor of binary fixed-point numbers where negative numbers are in sign-2's-complement form. You are provided with the following register configuration. **(3+5+5+5+5+6=29)**



Register Configuration for Question 1(a)

A High in the mode selection bit q_a initiates an addition operation while High in q_s initiates a 2's complement subtraction operation. Note that you have no register to store any Flag bit. However, in your design, you can use any flag generated by the ALU asynchronously. Now do the following tasks.

(i) Derive an algorithm that minimizes the number of different conditions to consider depending on the sign of the numbers and the operation to perform.

(ii) Draw a flowchart for this sign-magnitude addition and subtraction.

(iii) Draw the system block diagram showing every necessary signal.

(iv) Draw a control state diagram based on the flowchart of your design.

(v) Derive the Boolean functions for each control signal.

(vi) Design a hardwired control unit using J-K Flip Flop and Decoder for this adder-subtractor.

(**Hint:** Try to incorporate the C_{out} bit of your ALU. If all the states can be represented using n bits, then use n J-K Flip Flops and $n \times 2^n$ Decoder)

Present State	Next State	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

Excitation Table of J-K Flip-Flop for Question 1(a)

Contd P/2

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Contd ... Q. No. 1

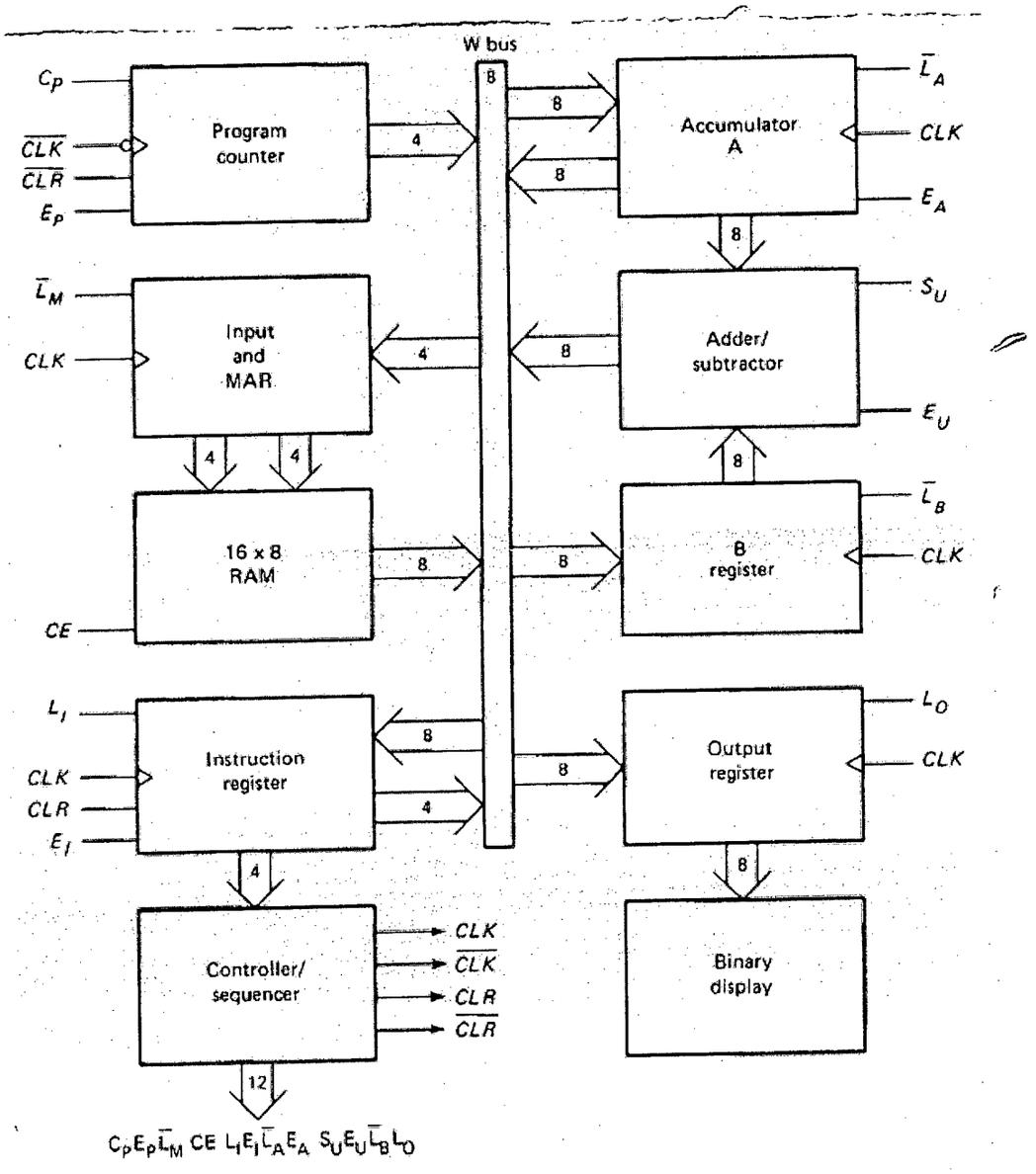
(b) Describe the differences between the call instruction execution in SAP-2 and SAP-3 architecture. **(6)**

2. (a) Assume, there are four 8-bit registers **AX, BX, CX** and **DX** in the system. Currently **AX** = 0x9B, **BX** = 0x29. If a multiplication **AX** × **BX** is performed in the system, then **CX : DX** contains the multiplication result. Now answer the following question according to the radix 4 Booth's multiplication algorithm: **(10+5=15)**

(i) What will be the content of **CX:DX** after **AX** × **BX**?

(ii) Show a performance comparison of the above algorithm with the normal multiplication algorithm and Booth's algorithm for the given input.

(b) Tite has taught SAP-1 architecture to Neymar. To check whether Neymar has understood SAP-1 architecture or not. Tite has given the following SAP-1 block diagram to Neymar and asked him to answer the following questions according to the diagram: **(4+4+4+8=20)**



SAP-1 Block Diagram for Question 2 (b)

Contd P/3

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Contd ... Q. No. 2(b)

(i) What Control word is active at the positive clock edge of T_6 state during **ADD** instruction execution?

(ii) What Control word is generated at the starting negative clock edge of T_3 state during **OUT** instruction?

(iii) What Control word is active at the positive clock edge of T_5 state during **LDA** instruction execution?

(iv) Write down the timing diagram of **SUB** instruction showing all required signals.

Now, write down the correct and complete answer that Neymar should provide in reply to Tite's tricky (!) question. (**Hint:** For the given SAP-1 block diagram, Control Word is $C_P\ E_P\ L'_M\ CE\ L_I\ E_I\ L'_A\ E_A\ S_U\ E_U\ L'_B\ L_O$)

3. (a) Answer the following questions with respect to Booth's multiplication algorithm: **(9+5=14)**

(i) Describe the main working principle of Booth's multiplication algorithm showing necessary derivations.

(ii) Is it better than the normal multiplication algorithm? Justify your answer.

(b) How are data transferred from memory to a peripheral device using DMA controller 8237? **(7)**

(c) Differentiate between **ADD B** and **DAD B** instruction with an example in SAP-3 architecture. **(6)**

(d) Write an SAP-2 assembly program that receives input a byte of data from port 1 using handshaking and stores the data in a register named B. **(8)**

4. (a) SAP-3 has a clock frequency of 1 MHz. How long does it take to execute the following SAP-3 subroutine? The required number of T-states for each instruction is given below. **(5)**

```
    MVI B, 0EH
    LOOP_S:
       MVI C, 48H
    LOOP_A:
       DCR C
       JNZ LOOP_A
       DCR B
       JNZ LOOP_S
       RET
```

SAP-3 Subroutine for Question 4(a)

Instruction	Required T-states
MVI	7
RET	10
DCR	4
JNZ	10/7

Required T-states for Question 4(a)

(b) Write down the decision table used in bit pair Booth's multiplication algorithm and describe the reasons behind each decision? **(12)**

(c) Give a brief comparison between block and demand transfer modes of programmable DMA controller 8237. Describe with illustrative examples. **(8)**

Contd P/4

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Contd ... Q. No. 4

(d) How many memory bytes are used to store A **CALL** and an **ANI** instruction in SAP-2 separately? Justify your answer. **(5)**

(e) Why positive clock edge occurs halfway through each T State in SAP-1? **(5)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is handshaking? Briefly describe the methods of parallel data transfer w.r.t. interfacing with I/O system. **(3+12=15)**

   (b) Draw the complete **block diagram of 8255** Programmable Peripheral Interface showing all of its major components. Briefly describe the major components. **(14+6=20)**

6. (a) How a keyboard is connected with a microprocessor? Draw the flow chart for software keyboard interfacing. **(5+10=15)**

   (b) The figure of a common anode seven segment display is given below. What should be the value of D to display 5? **(5)**

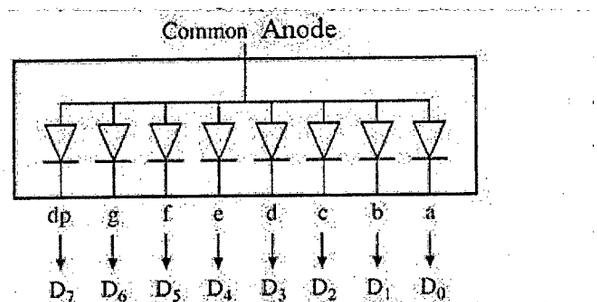

Figure for Question 6(b)

   (c) Mention five applications of **Programmable Interrupt Timer, 8254.** **(5)**

   (d) **8086** has its own interrupt pins. Is it sufficient to interface with 4 hardwares simultaneously where each hardware can generate interrupt? If yes, provide appropriate reasoning. Otherwise, explain how you can solve it. **(10)**

7. (a) Draw the block diagram of **8254 Programmable Interrupt Timer.** Briefly describe its major components. **(14+6=20)**

   (b) Why a counter value must be latched in **8254** before CPU read? **(5)**

   (c) How interrupt is executed using **Programmable Interrupt Controller 8259**? **(10)**

8. (a) Design an arithmetic unit using two selection variables, S_0 and S_1, that generates the following arithmetic operations (use an adder and basic gates). Your design should be optimized. Show the necessary circuits and equations only for single bit. **(20)**

CSE 403

Contd ... Q. No. 8(a)

Table for Question 8(a)

S_0	S_1	$C_{in} = 0$	$C_{in} = 1$
0	0	$F = A + 1$	$F = A$
0	1	$F = B + 1$	$F = B$
1	0	$F = A - B$	$F = A - B - 1$
1	1	$F = B - A$	$F = B - A - 1$

(b) Suppose C_{in} is set to 0. Now, for each arithmetic operation designed in 8(a), write down the condition for which output carry is 1, Show necessary calculations. **(8)**

(c) Is there any difference between overflow and carry? How overflow flag is calculated while adding two signed numbers? **(2+5=7)**
