BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2013-2014

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

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Compare simple reflex agent, table-driven agent and agents with memory   **(9)**

    (b) Define omniscience, autonomy and rationality of an agent. Give examples.   **(6)**

    (c) Consider a modified version of the vacuum cleaner environment in which the agent
    is penalized one point for each movement. Can a simple reflex agent be perfectly
    rational for this environment? Why? How will a reflex agent with state perform in this
    environment?   **(15)**

    (d) Develop a PEAS description of a robot soccer player.   **(5)**

2. (a) Give examples of the following types of environments (i) Fully observable, (ii)
    episodic (iii) dynamic (iv) stochastic, (v) multi-agent.   **(7)**

    (b) Derive the state space size of n-queens problem. Show your calculations.   **(8)**

    (c) Give the initial state, goal test, successor function and cost function for the following
    problem.   **(15)**

    You have three jugs, measuring 12 gallons, 8 gallons and 3 gallons and a water faucet.
    You can fill the jugs up or empty them out from one to another or onto the ground. You
    need to measure out exactly one gallon.

    (d) Find out a solution for the problem in Ques. No. 2(c) using your own formulation.   **(5)**

3. (a) Consider a state space where the start state is number 1 and successor function for
    state n returns two states: numbers 2n and 2n+1.   **(3+7+3+7=20)**

    (i)   Draw the portion of the state space for states 1 to 25.

    (ii) Suppose the goal state is 19. List the order in which nodes will be visited for
    breadth-first search, depth-first search, depth-limited search with limit 4 and
    iterative deepening search.

    (iii) Which of the search approach finds the goal state in least time?

    (iv) How would bi-directional search work in this problem? What is the branching
    factor in each direction?

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Contd... Q. No. 3

(b) Consider the sensorless two-location vacuum cleaner world. Draw the belief state space reachable from the initial belief state. Is the problem solvable or not? Justify your answer. **(7)**

(c) What are the main problems of hill climbing search? How does simulated annealing solve the problems? **(8)**

4 (a) When is A* search optimal? Explain its necessary condition with an example. **(7)**

(b) How does Recursive Best-First Search (RBFS) solve the main problem of A* search? Give suitable example. **(10)**

(c) How can you use genetic algorithm to solve 8-queens problem? Explain using an example. You must explain each step of the genetic algorithm including the design of each individual of your example. **(12)**

(d) Explain how local beam search works. What is the main difference with random-restart search? **(6)**

SECTION – B

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

5. (a) Explain why it is a good heuristic to choose the variable that is the most constrained but the value that is the least constraining in a CSP search. **(7)**

(b) Consider a scenario where for solving a CSP problem you have run the arc consistency algorithm. The algorithm reduced domains of some variables. Some of the variables have multiple values in their domains after the algorithm is run and no domain is empty. Is there a guaranteed solution? Justify your answer briefly with suitable examples. **(8)**

(c) Consider the game tree below. Use Alpha-Beta pruning to determine the value for the root node. Clearly show which branches are pruned by the algorithm. While expanding a node, the children are to be visited from left to right. **(20)**

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6. (a) Consider the problem of magic sequence. Given a finite integer n, the problem consists of finding a sequence of integers, $S = (s_0, s_1, ..., s_n)$, such that s_i represents the number of occurrences of i in S. As an example, when n = 4, one magic sequence is (2, 0, 2, 0), here $s_0 = 2$, $s_2 = 2$ as there are two 0s and two 2s in the sequence and $s_1 = 0$, $s_3 = 0$ as there are no 1s and 3s. Another example is (1, 2, 1, 0). Formulate the magic sequence problem as a formal Constraint Satisfaction Problem (CSP) with proper mathematical notations. (7)

(b) Consider the problem of "Wumpus World". Wumpus world is represented by 4×4 grid. Initially the agent is at [1,1]. There is one Wumpus is one of the 16 squares except [1,1]. There are four pits in the squares except [1,1]. The position of Wumpus and Pits are randomly distributed, but Wumpus cannot live in a square containing pit. Squares adjacent to Wumpus are smelly and adjacent to pits are breezy. The grid is shown below. (18)

1,4	2,4	3,4	4,4
1,3	2,3	3,3	4,3
1,2	2,2	3,2	4,2
1,1	2,1	3,1	4,1

At [1,1], the agent perceives neither breeze nor stench. Then the agent moves to [2, 1] where it perceives only breeze but no stench. Then the agent moves to [1,2] (via [1,1]) where it perceive neither breeze nor stench. Then the agent moves to [1,3] where it perceives both stench and breeze.

Now can you proof the following propositions using the resolution algorithm? You only need to incorporate the clauses that you need to proof the following proposition.

(i) [2,2] contains no pit.

(ii) [3,1] contains a pit

(iii) [1,4] contains the Wumpus.

(c) After a yearly checkup, your friends is informed by his doctor that he has been tested positive for a very serious disease. The accuracy of the test is 99% (i.e. the probability of testing positive when indeed on has the disease is 0.99, as is the probability of testing negative when one does not have the disease). The disease is also very rare, only 1 out of 100,000 people gets affected by it. Now, given the above scenario, find out the actual probability of your friend having (and not having) the disease. (10)

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7. (a) Consider the following scenario and answer the following questions.   **(17)**

    "Mary goes swimming if and only if it is sunny or Friday, if Mary does not go swimming, then she goes to the library to study Artificial Intelligence (AI). Mary finds it difficult to study AI and this causes her headache. The days Mary does not go to swimming and also has a headache, she goes to consult Dr. Barry. If Mary consults Dr. Barry on Friday, Dr. Barry kills Mary. If Mary consults Dr. Barry on any other days, Dr. Barry gives Mary Ice Cream. If Mary goes to library, then she does not return home by sunset. Today is not sunny and not Friday either"

    (i) Define the symbols you need to construct a Knowledge base using propositional logic. State the definitions clearly in a tabular format. One is done for you.

Definition	Symbol
Mary goes swimming	. Swim
..	..

    (ii) What are definite clauses? Build up a knowledge base for the given scenario. Every sentence must be a definite clause. You can declare new symbols too if needed.

    (iii) Apply "Forward Chaining" algorithm to proof that— "Dr. Barry gives Mary Ice Cream". Clearly show the algorithm steps.

    (b) Translate the following sentences into First Order Logic: **(5)**

    (i) Every Student who take AI is brilliant

    (ii) There is at least one student who took AI

    (iii) There is at least one student who took AI is nerd

    (iv) There is a person who loves everyone in the world

    (v) Everyone in the world is loved by at least one person.

    (c) What is Markov Blanket? Explain with an example.   **(5)**

    (d) Is alpha-beta pruning better than the mini-max algorithm? If yes, in which criteria? Is it guaranteed that alpha-beta pruning will always be better than mini-max algorithm? Justify your answer with example.   **(8)**

8. (a) Consider the following constraint graph for the map coloring problem. Each node can be colored either with red or blue (except node 3). **Node 3 can only be colored with blue.**   **(15)**

    Run backtracking algorithm with forward checking on this graph. And tabulate the assigned values and domains of different nodes as shown in the sample. The first 2 rows are already done for you. **Also indicate when the algorithm backtracks.** While coloring the graph, take nodes in increasing order of their label. That is, the algorithm will assign a value for node 1 first, then node 2, 3 and so on. You need to assign colors in the following order, **first red and then blue.** Mark the assigned values with circle.
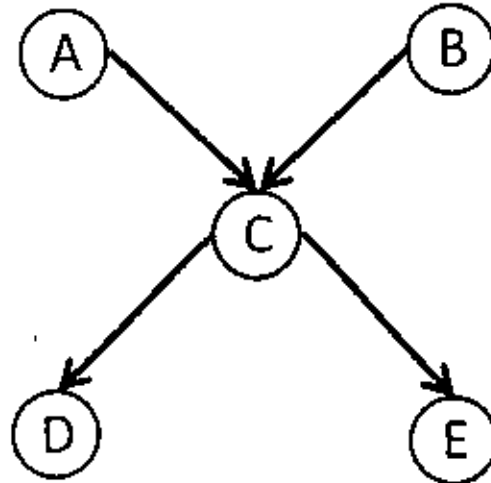
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Contd... Q. No. 8(a)
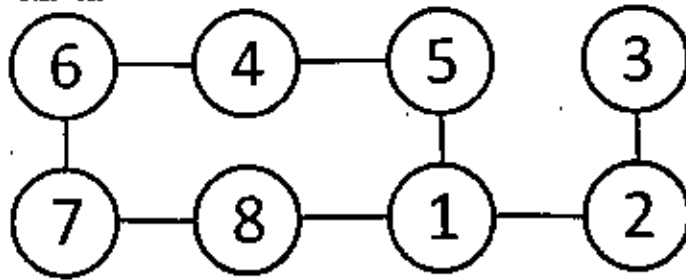
	1	2	3	4	5	6	7	8
Initial Domains	RB	RB	B	RB	RB	RB	RB	RB
1: R	(R)	B	B	RB	B	RB	RB	B
...	..	.	.		.	...	..	..

(b) Consider the following Bayesian Network. Find out the probability of the following query: P(B|D = True, E = False)　　　　　　　　　　　　　　　　　**(20)**

The CPT (Conditional Probability Tables) are given below:

A	B	P(C)
T	T	0.95
T	F	0.94
F	T	0.29
F	F	0.01

P(B)
0.3

P(A)
0.1

C	P(D)
T	0.90
F	0.05

C	P(E)
T	0.7
F	0.01

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B Sc. Engineering Examinations 2013-2014

Sub : **HUM 211** (Sociology)

Full Marks: 140   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Discuss the factors contributed to the development of sociology as a special branch

    of social sciences.   **(10)**

    (b) Describe the formalistic school and synthetic school of sociology.   **(13⅓)**

2. (a) 'Culture is a normative system of a society' — Explain.   **(10)**

    (b) Discuss Karl Marx's view of technology and culture.   **(13⅓)**

3 (a) What do you understand by socialization? Explain different types of socialization

    with examples.   **(10)**

    (b) Discuss Cooley's looking-glass self theory.   **(13⅓)**

4. Write short notes on any <u>three</u> of the following: **(23⅓)**

    (a)   The conditions of learning.

    (b)   Functionalist perspective

    (c)   Dominant ideology

    (d)   Ethnocentrism and cultural relativism.

SECTION – B

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

5. (a) Respond to those who assert that globalization is fueling nationalism, cultural

    reaction, and terrorist violence.   **(13⅓)**

    (b) In particular, what combination of advantages allowed Britain to experience

    industrialization first?   **(10)**

6 (a) Elaborately discuss the social effects of Industrial Revolution in Europe.   **(13⅓)**

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

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7   (a) In industrial society we found 'formal schooling open to the masses and viewed as a
means of advancing the social order' — R T Schaefer. Discuss the statement $(13\frac{1}{3})$
(b) Identify causes and effects of the major environmental pollution that usually happen
in Bangladesh.   **(10)**

8   Write short notes on any THREE of the following: $(23\frac{1}{3})$

   (a)   Multinational corporations

   (b)   Migration in 1971

   (c)   Types of internal migration in Bangladesh

   (d)   Calculation of CBR, CDR and TFR

L-4/T-1/CSE

Date : 07/07/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **HUM 213** (Government)

Full Marks: 140   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) What is internationalism? Discuss the merits of internationalism.   (11⅓)

   (b) 'Right imply duties' — Explain the statement on the basic of citizen rights and Duties.   (12)

2. (a) What are the essential elements of a state? Identify the differences between society and state   (11⅓)

   (b) Describe various types of sovereignty with examples.   (12)

3. (a) Who are the executive? Illustrate the role and functions of the executive in a state.   (11⅓)

   (b) Discuss the characteristics of democracy with relevant criticism   (12)

4. Write short notes on any three of the following: (23⅓)

   (a) Constitution
   (b) Ideal type of bureaucracy
   (c) Good Governance
   (d) Bicameral Legislature

SECTION – B

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

5. (a) Define foreign policy. Explain the major determinants of the foreign policy of Bangladesh   (11⅓)

   (b) Discuss in brief the merits and demerits of parliamentary form of government.   (12)

6. (a) Explain the salient features of the constitution of Bangladesh.   (11⅓)

   (b) Discuss the principal organs of United Nations Organizations.   (12)

7. (a) Define local government. Discuss the functions of local government in Bangladesh.   (11⅓)

   (b) Discuss the significance of the language movement of 1952.   (12)

8. (a) Discuss the political system of United Kingdom.   (11⅓)

   (b) Write short notes on the following topics.   (12)
       (i) Socialism
       (ii) Presidential form of government.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B Sc Engineering Examinations 2013-2014

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

Full Marks: 140   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) What do you understand by "Occupational Disease"? Give some example.   **(12)**

   (b) Describe briefly the circumstances under which an employer is legally liable to pay compensation and where he can refuse to pay the same.   **(11⅓)**

2. (a) Explain the meaning of the term "Wages" and "Bonus" as per Payment of Wages Act, 1936 Give five examples of Authorized Deduction   **(10)**

   (b) Lay down the provisions regarding the following: **(6)**

      (i)   Employers liability for payment of wages;

      (ii) Time for payment of wages;

      (iii) Mode of payment of wages

   (c) Write a critical note on deduction for absence from duty.   **(7⅓)**

3. (a) Define Trade Union and Collective Bargaining Aged as per Industrial Relations Ordinance, 1969   **(10)**

   (b) Describe briefly the formalities to be observed for registration of trade union.   **(9)**

   (c) Under what circumstances the registration of a trade union may be cancelled? What are the remedies available against such cancellation? Explain   **(4⅓)**

4. (a) Define the term 'Employer" and "Worker" as per Employment of Labor (Standing. Order), 1969. Show the classification of worker as per the above ordinance.   **(12)**

   (b) What do you understand by "Lay-off"? Describe the procedure of declaring such lay-off in a factory   **(11⅓)**

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SECTION – B

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

5   (a) What do you understand by Bill of Exchange? Show the specimen of such an
instrument   **(4)**

(b) Distinguish between a Bill of Exchange and cheque.   **(7)**

(c) Explain briefly the various grounds on which a cheque may be dishonored.   **(5)**

(d) How long a cheque legally remains in force from the date of drawing the same?
Explain the legal status of Hundi.   **(3⅓)**

(e) Explain the logic behind crossing a cheque.   **(4)**

6   (a) What do you understand by free consent? Explain its essential elements in a nutshell.   **(10)**

(b) What is Breach of contract? Discuss briefly the various remedies available to a party
aggrieved by such a breach.   **(13⅓)**

7.   (a) Compare and contrast between Public Limited Company and Private Limited
Company.   **(10)**

(b) Explain the meaning of the term 'Share' and 'Debenture' in relation to a company.   **(5)**

(c) Write a short note on Memorandum of Association.   **(8⅓)**

8.   (a) Define 'Partnership' as per Partnership Act, 1932 and highlight its salient features
with suitable example.   **(5)**

(b) Discuss briefly the formalities to be observed for the purpose of registration of a
partnership firm. Cite at least three legal disabilities suffered by an unregistered firm.   **(8)**

(c) What do you understand by 'Dissolution of a partnership firm'? Give a brief outline
of at least three mode of dissolving a partnership firm.   **(10⅓)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc Engineering Examinations 2013-2014

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

Full Marks: 210   .   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Show the timing waveform for double handshake data transfer. Indicate which signal
    is asserted by the sender and which signal is asserted by the receiver. Describe the
    meaning of each of the signal transitions.   **(10)**

    (b) Draw the internal block diagram of programmable parallel port device 8255A Why
    are the port lines of programmable port devices automatically put in the input mode
    . when the device is first powered up or reset.   **(15)**

    (c) Explain the mode 2 of operation and initialization of 8255A   **(10)**

2. (a) Design an 8-digit 7-segment LED display system using a single 7447 and software
    multiplexing method, interfacing with PC ports.   **(15)**

    (b) Write the algorithm for a procedure which refreshes the multiplexed LED displays as
    designed in question 2(a) in every 2ms   **(10)**

    (c) Show the hard-disk controller interface connections for ST-506 and SCSI I/O bus.
    Explain the data transfer using these interfaces.   **(10)**

3. (a) Design a semiconductor temperature sensor circuit using AD590 and AD580 to
    produce zero volt output for a temperature of 0°C. In what application might you use a
    temperature dependent current device such as the AD590 rather than a temperature -
    dependent voltage device such as the LM35?   **(15)**

    (b) Show the circuit connection of a 4-bit D/A converter using an operational amplifier
    741 and $V_{REF} = -5V$. Show the output voltage for different inputs.   **(10)**

    (c) What is the resolution of a 13 bit D/A converter? If the converter has a full-scale
    output of 10,000 V, what is the size of each step? What will be the actual maximum
    output voltage of this converter? What accuracy should this converter have to be
    consistent with this resolution?   **(10)**

CSE 403/CSE

4.   (a) Show in a diagram how a priority interrupt controller 8259A functions in an 8086
     system. Explain the interrupt acknowledge machine cycle. If the 8086 interrupt flag is
     set and the INTR input receives a high signal, write down the steps that are performed
     by 8086   **(15)**

     (b) Design a system using 74LS138 and 8259A to connect 15 interrupt signals.   **(10)**

     (c) Explain mode-3 operation of programmable counter 8254 using timing waveforms **(10)**

SECTION – B ·

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

5   (a) Design an arithmetic circuit with one selection variable S and two data inputs A and
    B. When S = 0, the circuit performs operation, $F = A - B$. When S = 1, the circuit
    performs operation, $F = A - B - 1$.   **(8)**

    (b) Write down the precondition(s) to turn on the overflow flag.   **(5)**

    (c) Suppose you have an arithmetic function $F = A - B$ and A>=B. What should be the
    value of Carry Out? Convert the function into a form that will support your answer **(2+5=7)**

    (d) How can you detect the following flags in 6 bits ALU? Briefly describe with
    equations (if necessary).   **(2+2+2+2=8)**

      (i)   Carry Flag
      (ii) Overflow flag
      (iii) Sign flag
      (iv) Zero flag

    (e) Suppose you have an arithmetic operation $F = A - B$ (signed 2's complement
    subtraction). If A>=B, then Boolean function, $Y = S \oplus V = (S'V' + SV)$ becomes 1
    (where S denotes Signed flag and V denotes Overflow flag.) The equation Y consists of
    two parts S'V' and SV. Why there are two separate parts in the equation?   **(7)**

6   (a) What are the basic characteristics of accumulator register.   **(5)**

    (b) Using JK flip-flops, design one typical stage of a register that performs the following
    micro operations. [you must draw the figure]   **(14)**

      (i)   P1: $A \leftarrow A + 1$ (increment operation)
      (ii) P2: $A \leftarrow AV (B \wedge C)$
                [Here P1 and P2 are control variables]

    (c) (i) What do you mean by control unit?   **(10)**

        (ii) Which one is better design method according to your opinion?
             a One flip-flop per state method
             b Microprogram control
    Give some explanation to support your choice.

    (d) Implement the following function using a PLA.   **(6)**

                    $F(A,B,C) = AB' + BC$

· 7. (a) Draw a flowchart and state diagram for the following algorithm, which results in 6A

for any input A. The algorithm is given below.   **(6+6+6)**

(i) Take input A and initialize variable S with 0.

(ii) For (int i=0;i<6.i++){

S=S+A;

}

(iii) Output S.

Implement the control unit for the algorithm using one flip-flop per state method.

(b) Design a simple scheme to convert SAP-1 computer from fixed machine cycle to

variable machine cycle.   **(7)**

[If you want to demonstrate any example, use the following control word

Lm' Cp Ep' La Lo'   ]

(c) Draw the timing diagram for LDA instruction for SAP-1 computer. [you must follow

Fig. 7(c)]   **(6)**

Fig. 7(c)

(d) Suppose the initial accumulator value is A = 1001 0001. What should be the output after applying each of the following operations? You should apply each of the operations on the initial value of A. **(4)**

   (i)   CMA

   (ii) ANI 08H

   (iii) XRI 05H

   (iv) ORI 03H

8   (a) In SAP-3 what is the difference between ADD and ADC operation? **(7)**

(b) In SAP-3 what is the difference between RAL (Rotate All Left) and RLC (Rotate Left with Carry)? **(7)**

(c) Why do different instructions take different numbers of memory bytes to be stored in the memory in SAP-2? (Suppose LDA takes 3 bytes and ANI takes 2 bytes to be stored in the memory). **(7)**

(d) Which component is necessary for a PC to support nested call operation? If a PC supports Jump operation, does it mean it supports Call operation? **(4+3)**

(e) Briefly describe DAD instruction for SAP-3. **(7)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2013-2014

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) "A large proportion of discrete-event simulation studies involve modeling of a real-world queuing system" --- Justify the statement.   **(10)**

   (b) Define the following terms in the context of modeling queue operation and give suitable practical examples when they may arise.   **(12)**

   i) Balking

   ii) Jockeying

   iii) Reneging

   (c) Consider the following description of a ship harbor. Ships arrive in the harbor to unload their products. The harbor has a dock with two berths ad two cranes for unloading the ships. At most two ships can stay in the harbor. Ships arriving when both berths are occupied join a FIFO queue. When two ships are in the harbor, one crane works on each ship. When only one ship is in harbor, both cranes unload the ship and the (remaining) unloading time is cut in half. When both cranes are working on a single ship and a second ship arrives. one of the cranes immediately begins serving the second ship and the remaining unloading time of the first ship is doubled.   **(13)**

   Now, answer the following ---

   i)   Identify events and construct the event graph.

   ii) Identify random attributes and their possible distributions.

   iii) Identify simulation states and important statistical counters.

   iv) Write event routine for "ship leaves harbor".

2. (a) Answer the following questions regarding various probability distributions.   **(10)**

   i) Let $X \sim$ expo (I). What distribution does $Y = X^2$ follow?

   ii) Let N_1, N_2 and N_3 be three independent $N(0, 1)$ (i.e., standard normal). For what suitable value of a does $Y = \dfrac{aN_1}{\sqrt{N_2^2 + N_3^2}}$ follow Student's distribution?

   iii) Let $X_1 \sim$ Gamma $(a, 1)$, and $X_2 \sim$ Gamma $(b, 2)$. How can you obtain beta (a, b) from X_1 and X_2?.

   (b) What is maximum likelihood estimation (MLE) technique for estimating unknown parameters of a hypothesized distribution? Suppose you have a dataset of 20 samples with $\overline{X}(n) = 10.24$, $S^2(n) = 22.36$, and $n = 20$, which you hypothesize to be fitted by density $f(x) = \gamma(0.368)^x$, for an unknown parameter γ. Using MLE, find γ.   **(15)**

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(c) What constitutes quantile summary of observed data and how does it help in identifying distribution family of the observed data? How is q-quantile, x_q, defined for a random variable X? If $X \sim expo (\beta)$, then q for which $x_q = \beta$. **(10)**

3. (a) Describe how probability –probability plot (P-P plot) is constructed for determining "quality" of the fitted distribution obtained from observed data. **(10)**

(b) What is goodness-of-fit test? What is the null hypothesis for this kind of test? Describe how test statistic is computed I chi-square tests and derive the condition on which the null hypothesis is rejected at a certain level α. **(15)**

(c) What does validity mean in chi-square tests? For chi-square tests with equiprobable intervals, show that interval end points a_j are given by , $a_j = \hat{F}^{-1}(j / N)$, where n is the number of observed data **(10)**

4. (a) What is inverse-transform method of generating random variates? Prove that the method is indeed correct. What are the drawbacks of this method **(6)**

(b) Give inverse-transform methods for generating variates with - **(9)**

i) density, $f(x) = \dfrac{1}{x^2}, \quad x > 1$

ii) cumulative distribution $F(x) = e^{-e^{-x}}, \quad -\infty < x < \infty$

iii) mass $p(i) = 1/6$, for $i = 1, 2, 3$

(c) Let us devise an acceptance-rejection method for generating beta (2, 2) variates as **(20)** follows. Using the fact that beta (2, 2) has density $f(x) = 6x(1-x)$ and the density is symmetric around ½ , one can think of suitably scaled sine function to "majorize" beta (2, 2) density as shown below. In figure.; the suggested sine function barely touches beta density at $x = \frac{1}{2}$.
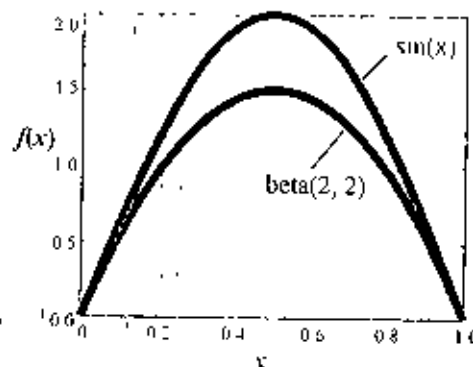
Figure for Question 4(b)

Based on the above mentioned construct, find a suitable majorizing function $f(x)$ for beta (2, 2). Hence, give the associated acceptance-rejection method for generating beta (2, 2) variates. How many random numbers (i.e., U (0, 1), you need, on an average, to produce each single variate in this approach?

[You may find the identify $\int \sin(ax)dx = -\dfrac{1}{a}\cos(ax)$ useful]

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SECTION-B

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

5. (a) Using Monte Carlo simulation technique, solve the following problems: (7+8)

   i) Determine the value Π

   ii) Compute the following integral:

   $$I = \int_0^2 e^{x^3}$$

   Use at least 10 random numbers to solve each problem. for generating random numbers, i.e. U (0, 1), pick numbers out of your mind or use calculator's RAND button

   (b) Draw flowchart diagrams for the arrival and the departure events in the simulation of a single server queuing model. (5+5)

   (c) What is the difference between next-event time advance and fixed-increment time advance methods in discrete-event simulation? How is the later method a special case of the former method? (6+4)

6. (a) Suppose that X and Y are jointly discrete random variables with (4+2+7)

   $$p(x, \; y) = \begin{cases} \dfrac{xy}{50} & \text{for } x = 1, 2, 3, 4 \text{ and } y = 4, 5, 6 \\ 0 & \text{otherwise} \end{cases}$$

   i) Compute $p_x(x)$, $p_y(y)$, $F_x(x)$ and $F_y(y)$.

   ii) Are the variables X and Y independent?

   iii) Compute $E(x)$, $Var(X)$, $E(Y)$, $Var(Y)$, $E(XY)$, $Cov(X,Y)$ and $Cor(X,Y)$.

   (b) Suppose that the 10 observations 5.5, 6.2, 5 8, 4.9, 5.7, 3 1, 5.2, 8.6, 5.3 and 6.6 are from a distribution (close to normal) with unknown mean m. Assuming, $t_{9, 0.95} = 1.833$: (8+4)

   i) compute $\bar{X}(10)$, $S^2(10)$ and an approximate 90% confidence interval for μ.

   ii) Test the null hypothesis $H_0: \mu = 5.5$ at level $\alpha = 0.10$.

   (c) Define the two types of errors that can be made while performing a hypothesis test. What is the danger of replacing a probability distribution by its mean? Explain with an appropriate example. (4+6)

7. (a) From your experienced in real world, design a queuing model that simulates the behavior of traffic in a 4-way intersection. Assume that each of the 4 roads meeting at the junction allows bidirectional traffic. You do not need to derive any measure or show simulation. Only briefly describe the necessary elements in your model. (15)

   (b) Define Correlation between two random variables. Are uncorrelated random variables bound to be independent? Why/ why not? Explain. (3+5)

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(c) Write down the properties of a good arithmetic random-number generator. Starting with 3571 generate the next four 4-digit random numbers using the mid-square method of random-number generation. **(6+6)**

8. (a) Multiplicative LCGs cannot have full period. Why? Why is m chosen as a large prime number instead of a power to 2 in multiplicative LCGs. **(6+6)**

(b) Prove that the average of the U_i's taken over an entire cycle of a full-period LCG is

$$\frac{m-1}{2m}$$ **(12)**

(c) Suggest a composite random-number generation method. Describe the idea behind the lattice test for random-number generators. **(6+5)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2013-2014

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

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Define the diameter and the radius of a graph. Compute the eccentricities of the
   vertices in the graph in Figure 1.   **(5+10=15)**
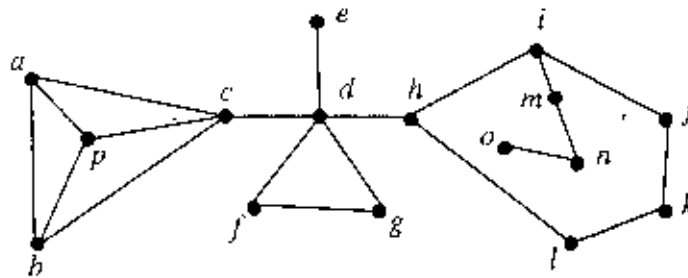
Figure 1 Figure for Question Number 1(a)

   (b) Write an efficient algorithm for finding the center of a tree.   **(8)**

   (c) Describe the importance of finding a minimum dominating set in a graph from the
   application point of view. Let G be a connected simple graph, $\gamma(G)$ be the domination
   number of G and diam(G) be the diameter of G. Then show that   **(5+7=12)**

   $$\gamma(G) \geq \left\lceil \frac{diam(G)+1}{3} \right\rceil$$

2. (a) fine a matching in a graph. What is a perfect matching? Show that every connected
   component of the symmetric difference of two matchings in a graph is a path or an even
   cycle.   **(2+2+6=10)**

   (b) Define the chromatic number and the chromatic index of a graph with illustrative
   examples. Let G be a bipartite graph with the maximum degree Δ. Then prove that
   $\chi'(G) = \Delta$.   **(5+10=15)**

   (c) What does the chromatic polynomial $P_G(k)$ of a graph indicate? Prove that for a tree
   of n vertices the relation $P_G(k) = k(k-1)^{n-1}$ holds.   **(3+7=10)**

3. (a) Show that $K_{3,3}$ is non-planar.   **(5)**

   (b) Let G be a connected simple plane graph, and let n, m, and f denote respectively the
   numbers of vertices, edges and faces of G. Then prove that $n - m + f = 2$.   **(7)**

(c) Show that every maximal planar graph of four or more vertices has at least four vertices of degree five or less. **(7)**

(d) Construct a simple plane graph whose dual graph contains a loop and multiple edges. Draw the dual of your graph. **(5)**

(e) Prove that every simple planar graph has a straight-line drawing. **(11)**

4. (a) What is a tournament? Show that every tournament T contains a Hamiltonian path. **(2+8=10)**

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

(c) Construct a clique tree representation for the chordal graph in Figure 2. **(5)**
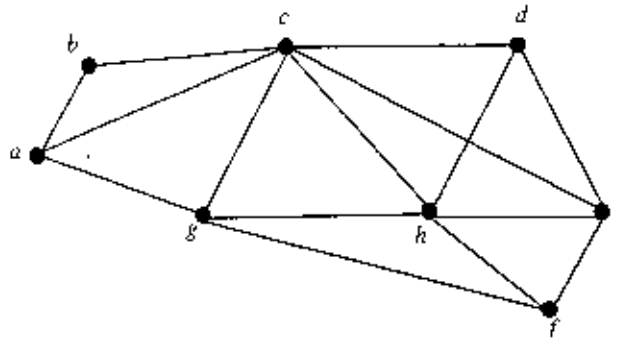
Figure 2 Figure for Question Number 4(c).

(d) Define a tree decomposition of a graph with an illustrative example. What is the treewidth of a graph? Explain the importance of treewidth from algorithmic point of view. **(5+2+3=10)**

SECTION – B

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

5. (a) There are five jobs {J1, J2, J3, J4, J5} in a company for which there are five workers A, B, C, D & E to do those jobs. However, everybody does not have expertise to do every job. Their expertise is as follows: $A = \{J1, J2, J3\}$, $B = \{J2, J4\}$, $C = \{J1, J3, J5\}$, $D = \{J3, J5\}$, $E = \{J1, J5\}$ 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. Comment on the properties of the graph you constructed and the approach that you are using to find the assignment. **(10)**

(b) Let $G = (V, E)$ be a graph with m edges and n nodes. Then show that, **(15)**

(i) $\sum_{v \in V} \deg(v) = 2m$.

(ii) The number of odd degree vertices is an even number.

(iii) $\delta(G) \leq 2m/n \leq \Delta(G)$.

(c) Draw simple cycle. Petersen graph, 4-dimensional hypercube and doughnut graph.

Find out the similarity among them. **(4+2=6)**

(d) What is the necessary and sufficient condition for $K_{m,n}$ to be a regular graph? **(4)**

6. (a) What is Union of graphs? Suppose there are $h + g$ people in a party; h of them are hosts and g of them are guests. Each person shakes hands with each other except that no host shakes hands with any other host. The problem is to find the total number of handshakes. Find out suitable graphs and model the solution using union of graphs. **(2+5=7)**

(b) Draw the graph $G = (V,E)$ with vertex set $V = \{a, b, c, d, e, f, g, h\}$ and edge set $\{(a, b), (a, c), (b, c), (b, d), (c, d), (c, g), (d, e)(e, f), (f, g), (f, h), (g, h)\}$. Draw $G - (d, e)$. Draw the subgraph of G induced by $\{c, d, e, f\}$. Contract the edge (d, c) from G. **(2+2+2+2=8)**

(c) What is self complementary graph? Give two examples of self complementary graphs. **(2+3=5)**

(d) Define "degree sequence" and "graphic sequence". Find the minimum value of x for which the sequence $(6, 5, x, 2, 2, 2, 1, 1)$ becomes a graphic sequence. Also construct a simple graph with that sequence. **(5+5+5=15)**

7. (a) Let G be a simple graph of n vertices, show that if G has k components, then the number m of edges of G satisfies. **(10)**

$$n - k \leq m \leq (n-k)(n-k+1)/2$$

(b) Show that, a connected graph G is Eulerian if and only if every vertex of G has even degree. Count the minimum number of edges required to add for making a non-Eulerian graph an Eulerian graph. **(8+4=12)**

(c) Let G be a simple graph of $n \geq 3$ vertices. Then show that, G is Hamiltoman if $d_G(u) + d_G(v) \leq n$ for every pair of non-adjacent vertices u and v in G. **(8)**

(d) Show that, a graph G is bipartite if and only if G does not contain an odd cycle. **(5)**
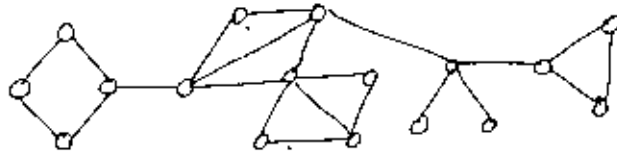
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8.(a)Define k-connected and k-edge-connected graph Show that, if G be a simple connected

graph, then $\kappa(G) \le \kappa'(G) \le \delta(G)$. **(10)**

(b) Let G be a connected graph and let 'e' be an edge in G. Show that,

$\tau(G) \le \tau(G-e) + \tau(G \setminus e)$. **(8)**

Here, $\tau(G)$ denotes the number of spanning trees of a connected graph G.

(c) Show that, there are n^{n-2} distinct labeled tree of n vertices. **(12)**

(d) Draw Block-cutvertex tree for the following graph. **(5)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc Engineering Examinations 2013-2014

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) Discuss different managerial levels. How are these levels associated with different basic managerial skills? (15)

   (b) Following data shows the demand of a certain product for 5 consecutive months. (20)

Month	1	2	3	4	5	6	7
Demand	76	80	83	90	95	86	98

   Find the forecasted demand for month 2 to month 8 using weighted moving average method and exponential smoothing method. Which method gives higher forecasted demand for 8th month? In case of weighted moving average method, take the weights to be 0.4 for most recent month. 0.3 for next, 0.2 for next and then 0.1 for next month. For exponential smoothing method take the smoothing constant to be 0.15.

2. (a) Discuss Henry Fayol's fourteen principles of management. (20)

   (b) Consider a worker of a shoe factory has to produce 360 pairs of shoes The standard task is 80 pieces, where the low task is 75% of the standard task. It the wage rate is \$30 per hour and the worker takes 4 hours to complete the task, then calculate his earnings per hour under Rowan plan. How much more or less he will earn per hour if the company uses Halsey plan? (15)

3. (a) Discuss different aspects of quality that customers may value. (20)

   (b) Dukes Auto uses 900 spark plugs a year. Plugs are priced as follows: for 1 to 49 units, \$6 each, for 50 to 99 units \$5 each, and 100 units or more, \$ 4.5 each. It costs approximately \$ 20 to prepare an order and receive it and holding costs are 80 percent of purchase price per unit on an annual basis. Determine the optional order quantity and the minimum total annual cost. (15)

4 (a) Discuss five basic sources of power with necessary examples. (12)

   (b) Describe different stages of team development. (10)

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Contd ... Q. No. 4

(c) Seven jobs must be processed in two operations: A and B. All seven jobs must go through A and B in that sequence – A first, then B. Using the times below, determine the optional order in which the jobs should be sequenced through the two processes. Also draw the optimum schedule with time indication (13)

Job	Process A	Process B
1	11	6
2	8	5
3	7	8
4	6	3
5	1	2
6	2	6
7	4	8

SECTION-B

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

5. (a) Describe the importance of production planning and control. (15)

(b) Lords Varys is a skilled manipulator and commands a network of informants across two continents. He has noticed considerable fluctuation in transferring information from month to month as shown below. Using high-low method, estimate the cost formula for transferring information. (8)

Month	No. of Information Transferred	Total Information Transferring Expense (in Gold Dragon Coin)
January	4	2200
February	7	3100
March	5	2600
April	2	1500
May	3	2200
June	6	3000
July	8	3600

(c) Ten Hall has recently opened a store specializing in fashionable stockings. Ms. Hall has just completed a course in managerial accounting and she believes that she can apply certain aspects of the course to her business. She is particularly interested in adopting the CVP approach in decision making. Thus, she prepared the following analysis: (12)

JPE 493

Contd ... Q. No. 5(c)

Sales price per pair of stockings	$2.00
Variable expense per pair of stockings	$0.80
CM per pair of stockings	$1.20
Fixed expenses per year:	
Building Rental	$12,000
Equipment Depreciation	$3,000
Selling	$30,000
Administrative	$15,000
Total fixed expenses	$60,000

Required:

i. How many pairs of stockings must be sold to break even? What does this represent in total dollar sales?

ii Prepare a CVP graph for the store from a zero level of activity up to 70,000 pairs of stockings sold each year. Indicate the break-even point in the graph.

iii. How many pairs of stockings must be sold to earn a $9,000 target profit for the first year?

iv Ms. Hall now has one full time and one part time salesperson working in the store. It will cost her an additional $8,000 per year to convert the part time position to a full time position and this will bring in an additional $20,000 in sales each year. Should she convert the position? Use the incremental approach.

6. (a) Dexter Corporation produces and sells a single product, a wooden hand loom for weaving small items such as scarves. Selected cost and operating data relating to the product for two years are given below: (20)

Selling price per unit	$50
Manufacturing costs:	$0 80
Variable per unit produced:	
Direct materials	·$11
Direct labor	$6
Variable overhead	$3
Fixed per year	$120,000
Selling and administrative costs:	
Variable per unit sold	$4
Fixed per year	$70,000

	Year 1	Year 2
Units in begging inventory	0	2,000
Units produce during the year	10,000	6,000
Units sold during the year	8,000	8,000
Units in ending inventory	2,000	0

IPE 493

Contd ... Q. No. 6(a)

Required:

1. Assume the company uses absorption costing.

a. Compute the unit product cost in each year.

b. Prepare an income statement for each year.

ii. Assume the company uses variable costing.

a Compute the unit product cost in each year.

b. Prepare an income statement for each year.

iii Reconcile the variable costing and absorption costing net operating incomes.

(b) Describe various parts of the master budget and their inter-relationships.   (15)

7. (a) Solex Company manufactures three products from a common input in a joint processing operation. Joint processing costs up to the split off point total $100,000 per year. The company allocates these costs to the joint products on the basis of their total sales vale at the split off point These sales values are as follows· products X, $50,000; product Y, $90,000; and product Z, $60,000. Each product may be sold at the split-off point or processed further. Additional processing requires no special facilities. The additional processing costs and the sales value after further processing for each product (on an annual basis) are shown below: (10)

Product	Additional Processing Costs	Sales Value
X	$35,000	$80,000
Y	40,000	150,000
Z	12.000	75,000

Which product or products should be sold at the split-off point and which product or products should be processed further? Show computations

(b) Explain six environmental forces in marketing management.   (20)

(c) What do you understand by time value of money?   (5)

8 (a) Martin Company is considering the purchase of a new piece of equipment. Relevant information concerning the equipment follows: (10)

Purchase cost $180,000

Annual savings by the equipment $37,500

Life of the equipment   12 years

Compute the payback period and simple rate of return for the equipment.

(b) Explain the factors influencing consumer behavior.   (15)

(c) Briefly describe different patterns of target market selection with appropriate examples   (10)