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Code : 100602

B.Tech 6th Semester Exam., 2022

(New Course)

COMPUTER NETWORK

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer from the following (any *seven*) : 2×7=14

(a) A proxy server is used as the computer

(i) with external access

(ii) acting as a backup

(iii) performing file handling

(iv) accessing user permissions

(b) The term 'WAN' stands for

(i) Wide Area Net

(ii) Wide Access Network

(iii) Wide Area Network

(iv) Wide Access Net

(c) Which layer of the TCP/IP stack corresponds to the OSI model transport layer?

(i) Host-to-host

(ii) Application

(iii) Internet

(iv) Network access

(d) What is the maximum header size of an IP packet?

(i) 32 bytes

(ii) 64 bytes

(iii) 30 bytes

(iv) 60 bytes

(e) The address which is used to identify a process on a host is

(i) physical address

(ii) port address

(iii) logical address

(iv) specific address

(f) Which sublayer of the information link layer performs circuit functions that depend on the kind of medium?

(i) Media access control sublayer

(ii) Logical link control sublayer

(iii) Network interface control sublayer

(iv) Both (i) and (ii)

(g) Transport layer protocol deals with

(i) application-to-application communication

(ii) node-to-node communication

(iii) the process-to-process communication

(iv) Both (i) and (iii)

(h) FTP server

(i) maintains state information

(ii) is stateless

(iii) has single TCP connection for a file transfer

(iv) has UDP connection for file transfer

(Turn Over)

(i) Which of the following is the multiple access protocol for channel access control?

(i) CSMA/CD

(ii) CSMA/CA

(iii) Both CSMA/CD and CSMA/CA

(iv) HDLC

(j) Physical layer provides

(i) mechanical specifications of electrical connectors and cables

(ii) electrical specification of transmission line signal level

(iii) specification for IR over optical fiber

(iv) All of the above

2. Explain the duties of different layers in TCP/IP model. 14

3. What do you mean by the term 'ethernet'? What are the types of cable commonly used for ethernet? 14

4. Differentiate between pure aloha and slotted aloha with examples. 14

5. How data link layers provide flow and error control? Explain with examples. 14

6. Describe RIP routing protocol with an example. Explain count to infinity problem and its countermeasures. 14

7. An ISP is granted the block 80.70.56.0/21. The ISP needs to allocate addresses for two organizations each with 500 addresses, two organizations each with 250 addresses, and three organizations each with 50 addresses.

   (a) Find the number and range of addresses in the ISP block.

   (b) Find the range of addresses for each organization and the range of unallocated addresses. 14

8. How transport layer provides congestion control? Differentiate between leaky bucket and token bucket algorithms. 14

9. Explain the difference between TCP and UDP. A client residing on a host with IP address 122.45.12.7 sends a message to the corresponding server residing on a host with IP address 200.112.45.90. If the well-known port is 161 and the ephemeral port is 51000, what are the pair of socket addresses used in this communication? 14

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Code : 105601

B.Tech 6th Semester Exam., 2022

(New Course)

COMPILER DESIGN

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer for any *seven* of the following : 2×7=14

(a) Which of the following derivations does a top-down parser use while parsing an input string? The input is assumed to be scanned in left to right order.

(i) Leftmost derivation

(ii) Leftmost derivation traced out in reverse

(iii) Rightmost derivation

(iv) Rightmost derivation traced out in reverse

(b) What is the maximum number of reduce moves that can be taken by a bottom-up parser for a grammar with no epsilon- and unit-production (i.e., of type A->ε and A->a) to parse a string with n tokens?

(i) $n/2$

(ii) $n-1$

(iii) $2n-1$

(iv) 2^n

(c) In a bottom-up evaluation of a syntax directed definition, inherited attributes can

(i) always be evaluated

(ii) be evaluated only if the definition is L-attributed

(iii) be evaluated only if the definition has synthesized attributes

(iv) never be evaluated

(d) Consider the grammar shown below :

$$S \rightarrow CC$$
$$C \rightarrow cC \mid d$$

The grammar is

(i) LL(1)

(ii) SLR(1) but not LL(1)

(iii) LALR(1) but not SLR(1)

(iv) LR(1) but not LALR(1)

(e) The lexical analyzer takes _____ as input and produces a stream of _____ as output.

(i) source program, tokens

(ii) token, source program

(iii) Either of the two

(iv) None of the above

(f) In a compiler, when is the keyboards of a language are recognized?

(i) During the lexical analysis of a program

(ii) During parsing of the program

(iii) During the code generation

(iv) During the data flow analysis

(g) How many tokens are there in the following C statement?

printf("j=%d, & j=%x", j, & j)

(i) 4

(ii) 5

(iii) 9

(iv) 10

(h) How is the parsing precedence relation defined?

(i) To delimit the handle

(ii) Only for a certain pair of terminal

(iii) None of the above

(iv) All of the above

(i) Given the following expression grammar :

$$E \rightarrow E * F \mid F + E \mid F$$
$$F \rightarrow F - F \mid id$$

Which of the following is true?

(i) * has higher precedence than +

(ii) − has higher precedence than *

(iii) + and − have same precedence

(iv) + has higher precedence than *

(j) Shift reduce parsers are

(i) top-down parser

(ii) bottom-up parser

(iii) may be top-down or bottom-up

(iv) None of the above

2. *(a)* Write a lexical analyzer program to identify strings, sequences, comments, reserved words and identifiers.

   (b) Explain about the sources and criterions of code optimization as machine dependent and independent types. 7+7=14

3. *(a)* Construct the non-recursive predictive parse table for the given grammar and check the acceptance of input string **"abfcg"** :

   $S \rightarrow A$, $A \rightarrow aB / Ad$, $B \rightarrow bBC / f$, $C \rightarrow cg$

   (b) What is the relationship with lexical analyzer, regular expressions and transition diagram? Give an example. 7+7=14

4. *(a)* Explain the type system in type checker. Write the syntax directed definition for type checker.

   (b) What is activation record? Explain its usage in stack allocation strategy. How is it different from heap allocation? 7+7=14

5. (a) Draw and explain the runtime memory organization static storage allocation strategy with pros and cons.

(b) Differentiate inherited and synthesized attributes with an example. 7+7=14

6. (a) Define dataflow analysis. List out the procedures to analyze the data flow of structured programs.

(b) Draw a block diagram of phases of a compiler and indicate the main functions of each phase. 7+7=14

7. (a) What is intermediate code? Translate the expression

$$(a+b)/(c+d)*(a+b/c)-d$$

into quadruples, triples and indirect triples.

(b) Explain reducible and non-reducible flow graphs with an example each. 7+7=14

8. (a) What is machine-dependent optimization? Explain how peephole techniques function in this.

(b) Explain how type checking and error reporting are performed in compiler. Draw syntax tree and DAG for the statement

$$a=(a*b+c)\wedge(b+c)*b+c$$ 7+7=14

9. Explain the following with suitable example : $3\frac{1}{2} \times 4 = 14$

(a) Function preserving optimization techniques

(b) Reference counting garbage collectors

(c) Elimination of loop invariant variable

(d) Strength reduction

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Code : 105602

B.Tech 6th Semester Exam., 2022

(New Course)

MACHINE LEARNING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer/Answer the following (any *seven*) : 2×7=14

(a) Which of the following is *false* regarding regression?

(i) It relates inputs to outputs.

(ii) It is used for prediction.

(iii) It may be used for interpretation.

(iv) It discovers causal relationships.

(b) Consider a linear-regression model with $N = 3$ and $D = 1$ with input-output pairs as follows :

$y_1 = 22,\ x_1 = 1,\ y_2 = 3,\ x_2 = 1,\ y_3 = 3,\ x_3 = 2$

What is the gradient of mean-square error (MSE) with respect to β1 when $\beta_0 = 0$ and $\beta_1 = 1$? Give your answer correct to two decimal digits.

(c) You observe the following while fitting a linear regression to the data :

As you increase the amount of training data, the test error decreases and the training error increases. The train error is quite low (almost what you expect it to), while the test error is much higher than the train error. What do you think is the main reason behind this behaviour?

Choose the most probable option :

(i) High variance

(ii) High model bias

(iii) High estimation bias

(iv) None of the above

(d) The square of the correlation coefficient $r \wedge 2$ will always be positive and is called the

(i) regression

(ii) coefficient of determination

(iii) KNN

(iv) algorithm

(e) The parameter β_0 is termed as intercept term and the parameter β_1 is termed as slope parameter. These parameters are usually called as

(i) regressionists

(ii) coefficients

(iii) regressive

(iv) regression coefficients

(f) In order to calculate confidence intervals and hypothesis tests, it is assumed that the errors are independent and normally distributed with mean zero and

(i) mean

(ii) variance

(iii) SD

(iv) KNN

(g) Which of the following is *true* about residuals?

(i) Lower is better

(ii) Higher is better

(iii) (i) or (ii) depending on the situation

(iv) None of the above

(h) Suppose that we have N independent variables (X_1, X_2, ..., X_n) and dependent variable is Y. Now imagine that you are applying linear regression by fitting the best fit line using least square error on this data. You found that correlation coefficient for one of its variables (Say X_1) with Y is $-0{\cdot}95$. Which of the following is *true* for X_1?

(i) Relation between X_1 and Y is weak

(ii) Relation between X_1 and Y is strong

(iii) Relation between X_1 and Y is neutral

(iv) Correlation cannot judge the relationship

(i) Suppose you plotted a scatter plot between the residuals and predicted values in linear regression and you found that there is a relationship between them. Which of the following conclusions would you make about this situation?

(i) Since there is a relationship, it means our model is not good

(ii) Since there is a relationship, it means our model is good

(iii) Cannot say

(iv) None of the above

(j) What would be the root mean square training error for this data if you run a linear regression model of the form ($Y = A_0 + A_1 X$)?

(i) Less than zero

(ii) Greater than zero

(iii) Equal to zero

(iv) None of the above

2. (a) Discuss various challenges in machine learning based applications with suitable examples. 7

(b) Consider a learning problem where each instance is described by a conjunction of n Boolean attributes $a_1 \cdots a$. Thus, a typical instance would be

$$(a_1 = T) \wedge (a_2 = F) \wedge \cdots \wedge (a_n = T)$$

Now consider a hypothesis space H in which each hypothesis is a disjunction of constraints over these attributes. For example, a typical hypothesis would be

$$(a_1 = T) \vee (a_5 = F) \vee (a_7 = T)$$

Propose an algorithm that accepts a sequence of training examples and outputs a consistent hypothesis if one exists. Your algorithm should run in time that is polynomial in n and in the number of training examples. 7

3. (a) Consider the following set of training examples : 6

Instance	*Classification*	a_1	a_2
1	+	T	T
2	+	T	T
3	–	T	F
4	+	F	F
5	–	F	T
6	–	F	T

(i) What is the entropy of this collection of training examples with respect to the target function classification?

(ii) What is the information gain of a_2 relative to these training examples?

(b) Design a two-input perceptron that implements the Boolean function $A \wedge B$. Design a two-layer network of perceptrons that implements $A XOR B$. 8

4. (a) Consider a two-layer feedforward ANN with two inputs a and b, one hidden unit c, and one output unit d. This network has five weights $(w_{ca}, w_{cb}, w_{c0}, w_{dc}, w_{d0})$, where w_{x0} represents the threshold weight for unit x. Initialize these weights to the values $(\cdot 1, \cdot 1, \cdot 1, \cdot 1, \cdot 1)$, then give their values after each of the first two training iterations of the BACKPROPAGATION algorithm. Assume learning rate $\eta = 0 \cdot 3$, momentum $\alpha = 0 \cdot 9$, incremental weight updates, and the following training examples : 7

a	b	d
1	0	1
0	1	0

(b) Draw two-class, two-dimensional data such that (i) PCA and LDA find the same direction and (ii) PCA and LDA find totally different directions. 7

5. (a) Suppose you test a hypothesis h and find that it commits $r = 300$ errors on a sample S of $n = 1000$ randomly drawn test examples. What is the standard deviation in errors(h)? How does this compare to the standard deviation in the example at the end of Section 5·3·4? 6

(b) Considering the training data provided in the following table, try to build an associative classifier model by generating all relevant association rules with support and confidence thresholds 10% and 60% respectively. Classify using this model the new example :

age ≤ 30, income = medium, student = yes, credit-rating = fair, selecting the rule with the highest confidence. What would be the classification if we choose to vote the class among all rules that apply? 8

RID	age	income	student	credit_rating	class:buys_computer
1	≤ 30	high	no	fair	no
2	≤ 30	high	no	excellent	no
3	31...40	high	no	fair	yes
4	> 40	medium	no	fair	yes
5	> 40	low	yes	fair	yes
6	> 40	low	yes	excellent	no
7	31...40	low	yes	excellent	yes
8	≤ 30	medium	no	fair	no
9	≤ 30	low	yes	fair	yes
10	> 40	medium	yes	fair	yes
11	≤ 30	medium	yes	excellent	yes
12	31...40	medium	no	excellent	yes
13	31...40	high	yes	fair	yes
14	> 40	medium	no	excellent	no

6. *(a)* Draw the Bayesian belief network that represents the conditional independence assumptions of the naive Bayes classifier for the Play Tennis problem stated in the following table. Give the conditional probability table associated with the node wind. 8

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

(b) What is kernel regression and noise variance? Explain in detail. 6

7. (a) What is the lazy version of the eager decision tree learning algorithm? What are the advantages and disadvantages of your lazy algorithm compare to the original eager algorithm? 6

(b) What is clustering? Why do we use this in machine learning? Discuss the following algorithms : 8

(i) K-means

(ii) K-medoid

8. (a) How can machine learning techniques help to identify forged data recognition application? Explain the method in detail. 7

(b) Differentiate between supervised and unsupervised training. Explain with suitable examples. 7

9. Write short notes on the following : 4+5+5

(a) Linear Algebra for ML

(b) ANN

(c) Reinforcement Learning

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Code : 105616

B.Tech 6th Semester Exam., 2022

(New Course)

CRYPTOGRAPHY AND NETWORK SECURITY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) Advanced Encryption Standard (AES) has three different configurations with respect to number of rounds and

(i) data size

(ii) round size

(iii) key size

(iv) encryption size

(b) Which of the following is also known as key exchange algorithm?

(i) RSA

(ii) DES

(iii) DH

(iv) ECC

(c) RC4 is an example of

(i) hash algorithm

(ii) stream cipher

(iii) block cipher

(iv) None of the above

(d) Hash function is

(i) used to produce fingerprint of a file

(ii) useful for message authentication

(iii) Both (i) and (ii)

(iv) None of the above

(e) Which one of the following is not a higher-layer SSL protocol?

(i) Alert protocol

(ii) Handshake protocol

(iii) Alarm protocol

(iv) Change cipher spec protocol

(f) An HTTP connection uses port _____ whereas HTTPS uses port _____ and invokes SSL.

(i) 40; 80

(ii) 60; 620

(iii) 80; 443

(iv) 620; 80

(g) The DES algorithm cipher system consists of _____ rounds (iterations) each with a round key.

(i) 12 (ii) 18

(iii) 9 (iv) 16

(h) For $p = 11$ and $q = 19$ and choose $e = 17$. Apply RSA algorithm where message = 5 and find the cipher text.

(i) C = 80

(ii) C = 92

(iii) C = 56

(iv) C = 23

(i) SHA-1 produces a hash value of

(i) 256 bits

(ii) 160 bits

(iii) 180 bits

(iv) 128 bits

(j) In which of the following encryption key is used to encrypt and decrypt the data?

(i) Public key

(ii) Private key

(iii) Symmetric key

(iv) Asymmetric key

2. (a) What are the two general approaches to attack a cipher? List and briefly define the types of cryptanalytic attacks based on what is known to the attacker. 7

(b) What is the difference between a mono-alphabetic cipher and a polyalphabetic cipher? Explain with examples. 7

3. Explain the key generation process of AES cipher. We try now to take advances in computer technology into account. Predicting the future tends to be tricky but the estimate usually applied is Moore's law, which states that the computer power doubles every 18 months while the costs of integrated circuits stay constant. How many years do we have to wait until a key-search machine can be built for breaking AES with 128 bits with an average search time of 24 hours? Again, assume a budget of $1 million (do not take inflation into account). 14

4. Design a security service that provides data integrity, data confidentiality and non-repudiation using public-key cryptography in a two-party communication system over an insecure channel. Give a rationale that data integrity, confidentiality and nonrepudiation are achieved by your solution. (Recommendation : Consider the corresponding threats in your argumentation.) 14

5. In an RSA system, the public key of a given user is $e = 65$, $n = 2\ 8\ 8\ 1$. What is the private key of this user? Hint : First use trial-and-error to determine p and q; then use the extended Euclidean algorithm to find the multiplicative inverse of 31 modulo $\phi(n)$. 14

6. *(a)* What types of attacks are addressed by message authentication? Describe the basic uses of message authentication code. 7

   (b) Differentiate between the symmetric key cryptography and public key cryptography. 7

14

7. Explain the following :

   (a) X.509 Format of a certificate

   (b) Public key distribution

(Turn Over)

8. *(a)* Explain the working of Diffie-Hellman key exchange technique. 8

(b) Alice and Bob use the Diffie-Hellman key exchange technique with a common prime $q = 23$ and a primitive root $\alpha = 5$.

(i) If Bob has a public key $Y_B = 10$, what is Bob's private key Y_B? 3

(ii) If Alice has a public key $Y_A = 8$, what is the shared key K with Bob? 3

9. List the main features of the SHA-512 cryptographic hash. What kind of compression function is used in SHA-512? Compare the compression function of SHA-512 without the last operation (Final Padding) with a Feistel cipher of 80 rounds. Show the similarities and differences. 14

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Code : 105604

B.Tech 6th Semester Exam., 2022

(New Course)

GRAPH THEORY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) What is the number of edges present in a complete graph having n vertices?

(i) $(n*(n+1))/2$

(ii) n

(iii) $(n*(n-1))/2$

(iv) Information given is insufficient

(b) A connected planar graph having 6 vertices, 7 edges contains _____ regions.

(i) 17

(ii) 9

(iii) 3

(iv) 13

(c) Which of the following properties does a simple graph not hold?

(i) Must be unweighted

(ii) Must have no multiple edges

(iii) Must have no loops or multiple edges

(iv) Must be connected

(d) For a given graph G having v vertices and e edges which is connected and has no cycle, which of the following statements is *true*?

(i) $v = e + 1$

(ii) $v = e$

(iii) $v + 1 = e$

(iv) $v = e - 1$

(e) The time complexity to calculate the number of edges in a graph whose information is stored in the form of an adjacency matrix is

(i) $O(E)$

(ii) $O(V^2)$

(iii) $O(E^2)$

(iv) $O(V)$

(f) In a given connected graph G, what is the value of rad (G) and diam (G)?

(i) 2, 3

(ii) 2, 2

(iii) 3, 2

(iv) 3, 3

(g) The column sum in an incidence matrix for a directed graph having no self-loop is

(i) 1

(ii) 0

(iii) 2

(iv) 3

(h) A graph structured stack is a/an

(i) undirected graph

(ii) regular graph

(iii) directed graph

(iv) directed acyclic graph

(i) Graph structured stack finds its application in

(i) Todd-Coxeter algorithm

(ii) Heap sort

(iii) Bogosort

(iv) Tomita's algorithm

(j) What is the number of vertices of degree 2 in a path graph having n vertices where $n > 2$?

(i) n

(ii) $n-2$

(iii) 0

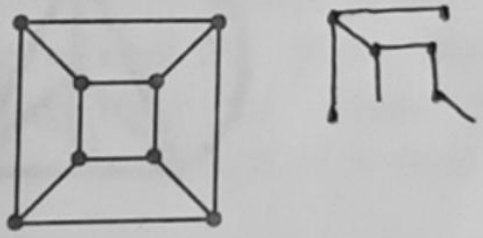
(iv) 2

2. *(a)* Prove that the chromatic number of a graph will not exceed by more than one the maximum degree of the vertices in a graph. 7

(b) If G is a graph with n vertices, it is said to have Hamiltonian cycle, if G has its all vertices degree at least $n/2$. Prove this theorem. 7

3. *(a)* Show a tree in which its diameter is not equal to twice the radius. Under what condition does this inequality hold? Elaborate. 5

(b) Sketch all spanning trees for the following graph : 4



(c) What is the nullity of a complete graph of n vertices? 5

4. *(a)* What is the edge connectivity of the complete graph of n vertices? 4

(b) Prove that in a connected graph G, a vertex v is a cut-vertex if and only if there exists two (or more) edges x and y incident on v such that no circuit in G includes both x and y. 5

(c) Is every regular graph of degree $d (d \geq 3)$ non-separable? If not, give a simple regular graph of degree three that is separable.

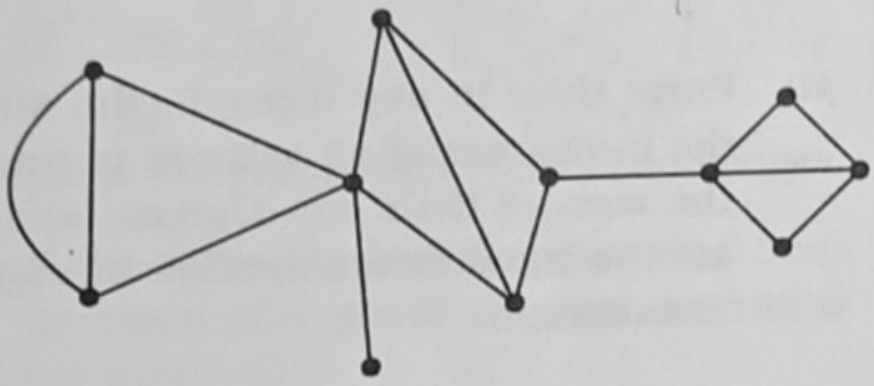
5. (a) A simple planar graph to which no edge can be added without destroying its planarity (while keeping the graph simple, of course) is called a maximal planar graph. Prove that every region in a maximal planar graph is a triangle.

(b) Draw the geometric dual of the following graph : 4

(c) Show that the edges forming a spanning tree in a planar graph G correspond to the edges forming a set of chords in the dual G^*. 5

6. (a) Show that, for a simple disconnected graph of k components, n vertices, and e edges, the ranks of matrices A, B and C are $n-k$, $e-n+k$ and $n-k$, respectively. 7

(b) After having labelled the graph in the following figure, write its adjacency matrix X. How does the fact that the graph is separable reflect in X? Characterize the adjacency matrix X of a separable graph, in general. 7



7. (a) A bipartite graph is said to be a complete bipartite graph if there is one edge between every vertex of set $V1$ to every vertex of set $V2$. Show that the maximum number of edges in a complete bipartite graph of n vertices is $[n^2/4]$. 7

(b) Using the proper coloring for n vertices with m available colors, solve the following :

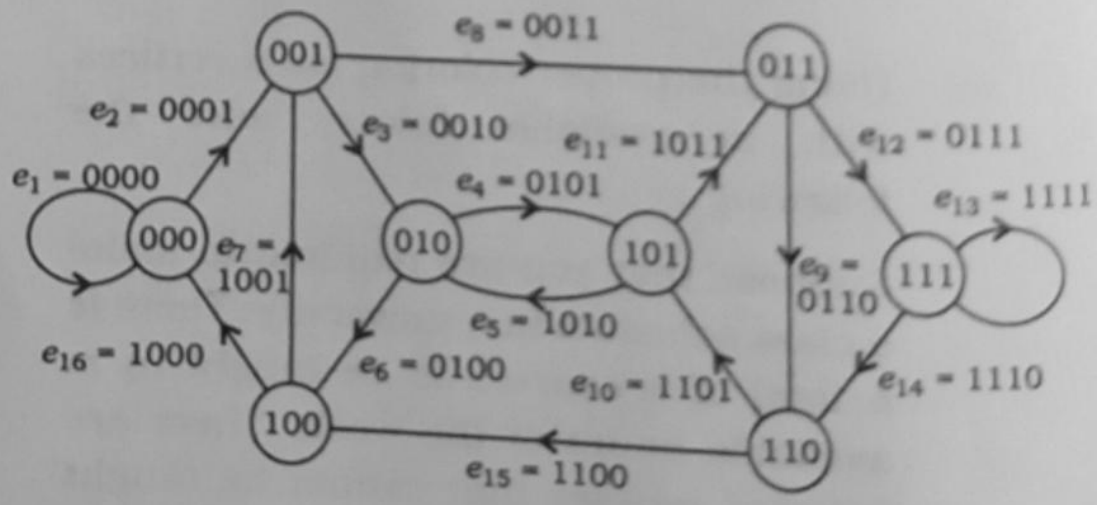
Suppose that you are required to make a class schedule in a university. There is a total of n courses to be taught in m available hours of the week. There are pairs of courses that cannot be taught at the same time because some

students might like to take both. Explain how you will make the schedule. State the condition when it will be impossible to make a compatible schedule. 7

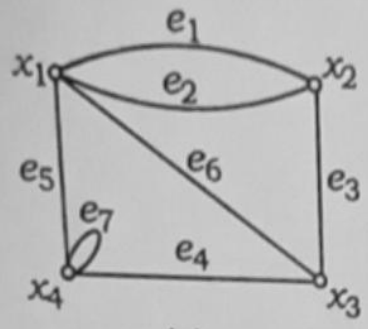
8. *(a)* Prove that, in any digraph, the sum of the in-degrees of all vertices is equal to the sum of their out-degrees; and this sum is equal to the number of edges in the digraph. 5

(b) If $E|G|$ is the number of Euler lines in an n-vertex Euler digraph G, show that $2^{n-1} \cdot E|G|$ is the number of Euler lines in $L(G)$. 4

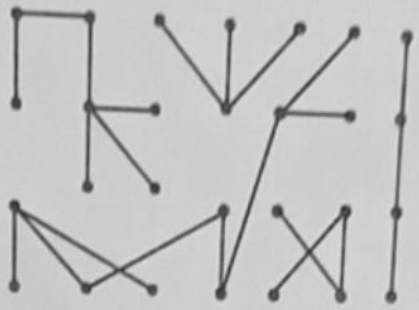
(c) List all 16 distinct directed Euler lines in the following figure : 5



9. *(a)* Write the incidence matrices for the labelled graph shown in (a) and (b) : 7



(a)



(b)

Label the graph with vertices and edges.

(b) If the following are the spanning trees (vertices) of a graph G, then determine the graph G : 7

$\{a, c, d, e\}$, $\{a, c, d, f\}$, $\{b, c, d, e\}$, $\{b, c, d, f\}$,
$\{a, c, e, f\}$, $\{b, c, e, f\}$, $\{a, d, e, f\}$, $\{b, d, e, f\}$,
$\{a, b, d, e\}$, $\{a, b, d, f\}$, $\{a, b, e, f\}$.

★ ★ ★