

Comprehensive Examination Question Paper
BITS, Pilani – Dubai, Dubai International Academic City, Dubai.
III Year First Semester 2010-2011

Degree: B.E.(Hons.) Branch: C.S.

Course No : CS C363 Course Title: Data Structures and Algorithms [Theory]
Date: 26, Dec., 20110 Wednesday Time: 10 a.m.- 1 Noon Total marks: 80
Weightage: 40% Data provided are complete. *Closed Book.*

Answer Part A and Part B in separate booklets provided to you.

PART A

- 1) What are the *average-case* and *worst-case* time complexities for MERGESORT and HEAPSORT? [2M]
- 2) **Define** the following class of problems and **mention an example** in each category:
a) P b) NP c) NP-HARD d) NP-COMPLETE [4 M]
- 3) What is a BLOOM FILTER? Mention a practical application of BLOOM FILTER. [2 M]
4. **Trace** through all the steps for PATTERN MATCHING using BOYER-MOORE algorithm [algorithm need not be written; only tracing needed] for the following input data:
String T: DATASTRUCTURESANDALGORITHMSCSC363
Pattern P: RITH [5 M]
5. Write the ALGORITHM(s) to perform the following operations on a TREE ADT (**general tree**) :
 - a) Compute the height of the sub-tree of tree T (**general tree**) rooted at node v
 - b) Pre-order Traversal of a Tree T (**general tree**).
 - c) Post-order Traversal of a Tree T (**general tree**). (3+2+2 M)

P.T.O.

6. Solve the given NP-COMPLETE problem TSP using each of the following strategies (algorithm not needed; solve it numerically):

- a) the **SHORTEST-LINK** strategy,
and
 b) the **NEAREST NEIGHBOR** strategy.

The problem is stated as follows:

A traveling salesperson (TSP) has to visit eight cities (A,B,C,D,E,F,G,H) and return to the starting city. Assume that he/she starts the tour from city **D**. He/she must visit every city and should visit it only once (he/she ends his tour by returning back to starting city). The cost of travel (i.e. distance) from city **i** to city **j** is given. Find out the optimal tour. (i.e. the tour involving minimum cost of travel (i.e. distance)). Assume undirected graph representation.

DE = 6 CD=8 BC=6 CE= 10 GH=4 AB=12 BE=13
 DH=3 EF=4 FG=13 AE=5 AF=3 CG=3

[5+5 M]

7. **Trace** through the successive steps for inserting the following keys, **in the given order**, into an initially empty **B-Tree** of degree 3. (i.e. $t=3$; an internal node can have between 2 to 5 keys):

47, 19, 39, 68, 26, 20, 17, 37, 27, 71, 24, 61, 34, 51, 44, 41, 54, 31, 64, 21 [10 M]

PART B

1. Answer the following questions with reference to a skip list.
 - a. What is the function of a skip list ?
 - b. Create and explain how a skip list for the following data is constructed :
 comb, table, chair, apple, cereal, mango, zebra, zoo, pen.
 - c. Show how the search for the item mango would proceed in the skip list you have created.
 - d. Give the algorithm for the insert procedure into a skip list.

(1 + 3 + 2 + 3M)

2. a. What are the different ways of representing graphs ?
- b. Give both the representations for the below given graphs given in Fig. 1 and Fig. 2.

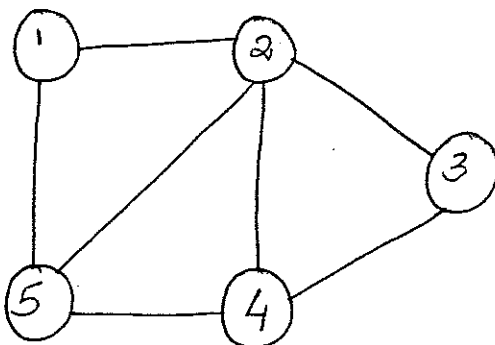


Fig. 1

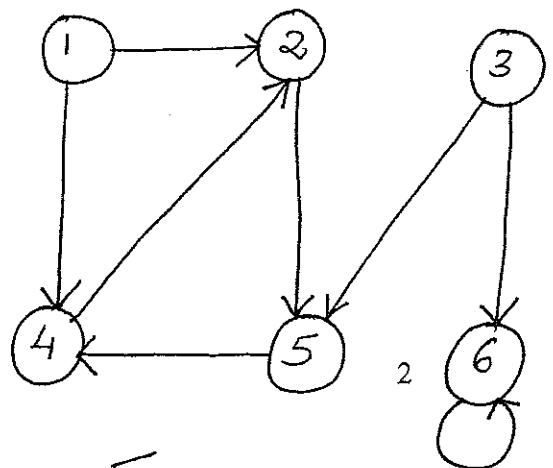


Fig. 2

c. What is the data structure used with Breadth First Search (BFS) ? Give the BFS traversal for the undirected graph of Fig.3 , clearly indicate the state of the specified data structure at each stage of the traversal. Assume that the graph traversal starts at node S.

d. Give the algorithm for the BFS traversal.

e. For the given graph $G=(V,E)$ in Fig.4 find i) V,E ii) all parallel edges iii) all loops iv) all isolated vertices v) Justify if G is a simple graph.

(1 + 4 + 4 + 3 + 3M)

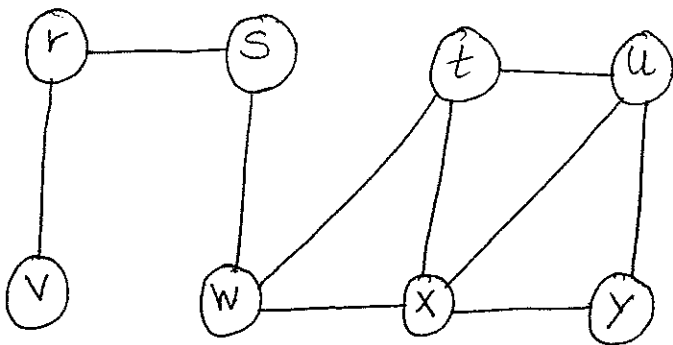


Fig. 3

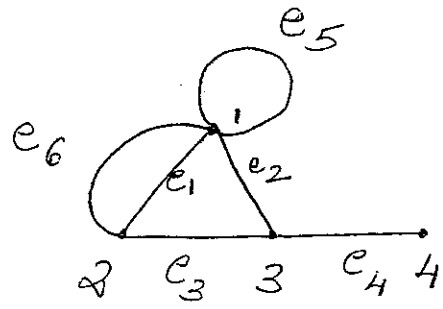


Fig. 4

3.a. Solve the fractional knapsack problem for the given weights, profits and knapsack capacity. Indicate which objects are chosen and give the maximum profit .Where weights are given by W, profit is given by P and maximum capacity by C.

W1 = 120 W2 = 150 W3=200
 P1 = 5 P2 = 5 P3 = 4
 C = 300

b. Give the greedy algorithm for solving the fractional knapsack problem.

c. Show how the dynamic programming algorithm computes the minimum number of scalar multiplications for the matrices $M_{4,3}$ $M_{3,5}$ $M_{5,2}$. Give the values of the array S. (Tabular form)

d. Draw the standard trie for the following set of strings { abab, baba, cccc, bbaaaa, caa, bbaacc, cbcc, cbca } (3 + 4 + 5 + 4M)

*****ALL THE BEST*****

BITS, Pilani- Dubai
Dubai International Academic City
First Semester 2010- 2011

Test 2 (Open book)

Course No. : BIOT C332

Maximum Marks: 20

Course Title: Genetics

Duration: 50 mins

Date: 21.11.2010

Attempt all the questions in the given sequence

Q1. The ability to taste the chemical PTC is determined by a single gene in humans with the ability to taste given by the dominant allele T and inability to taste by the recessive allele t. Suppose two heterozygous tasters (Tt) have a large family.

- a. Predict the proportion of their children who will be tasters and non-tasters. Use a Punnett square to illustrate how you make these predictions. [1M]
- b. What is the likelihood that their first child will be a taster? What is the likelihood that their fourth child will be a taster? [1M]
- c. What is the likelihood that the first three children of this couple will be non-tasters? [1M]

Q2. Hemophilia is a sex-linked trait (see pp. 136 - 137 in your text) where X^H gives normal blood clotting and is dominant to the hemophilia allele X^h .

- a. Give the genotypes of 1) a woman with normal blood clotting whose father had hemophilia and 2) a normal man whose father had hemophilia. [1M]
- b. What is the probability that a mating between these two individuals will produce a child, regardless of sex, that has hemophilia? [1M]
- c. If this couple has a daughter, what is the probability that the daughter will be a carrier of the hemophilia trait? [1M]
- d. What is the probability a daughter would have hemophilia? [1M]
- e. If this couple has a son, what is the probability he will have hemophilia? [1M]

Q3. A three point cross is a better method for gene mapping. Justify. [2M]

Q4. What is a selective media? Mention its two important advantages over enriched media. [3M]

Q5. After the F^+ cell donates the F factor to the recipient cell, it is not converted into a F^- cell. Justify. [2M]

Q6. In *E. coli*, the three loci *Str*, *phe* and *ara* are within 2 minute map distance apart. To determine the exact order and relative distance, the prototroph (*str*⁺ *phe*⁺ *ara*⁺) was infected with a transducing phage P2. The lysate was used to infect the auxotroph (*str*⁻ *phe*⁻ *ara*⁻). The *str*⁺ classes of transductants were selected to produce the following data:

<i>str</i> ⁺	<i>str</i> ⁺	<i>str</i> ⁺	<i>str</i> ⁺
<i>phe</i> ⁻	<i>phe</i> ⁺	<i>phe</i> ⁻	<i>phe</i> ⁺
<i>ara</i> ⁻	<i>ara</i> ⁻	<i>ara</i> ⁺	<i>ara</i> ⁺
127	73	0	300

- Mention the technique used to screen the different classes of transductants. [1M]
- What is the gene order and why? [2M]
- What are the relative cotransduction frequencies between the genes? [2M]

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BITS, PILANI- DUBAI
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FIRST SEMESTER 20010-2011
TEST – I (CLOSED BOOK)

Course No.: BIOT C332 **10.10.10** **Maximum Marks: 25**
Course Title: Genetics **Maximum Time: 50 minutes**

Attempt all the questions in the given sequence

- Q1. Explain the Griffith's experiment with a neat diagram. [4M]
- Q2. Write a short note on the Terminators of prokaryotic Transcription. [4M]
- Q3. The replication of the complementary strand of DNA is discontinuous. Justify. [6M]
- Q4. Explain the events that occur at the site of origin of DNA replication. [3M]
- Q5. Give the significance of [2M]
i. Pribnow box
ii. Rho protein
- Q6. Give the roles of the transcription factors of RNA polymerase II. [3M]
- Q7. Explain the self splicing of introns in the eukaryotic RNA. [3M]

SET A

BITS, PILANI- DUBAI
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FIRST SEMESTER 20010-2011
QUIZ- II (CLOSED BOOK)

Course No.: BIOT C332 15.12.10 Maximum Marks: 07
Course Title: GENETICS Maximum Time: 20 minutes

NAME: _____ ID NO: _____

Q1. What are linkers? [1]

Q2. Mention any two techniques of DNA delivery into eukaryotic cells. [1]

Q3. Give examples of any two reporter systems of prokaryotic origin. [1]

Q4. Give the significance of RFLP. [1]

Q5. Define an inducible operon.

[1]

Q6. What is zygotic induction?

[1]

Q7. What are the two types of transpositions?

[1]

SET A

BITS, PILANI- DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
FIRST SEMESTER 2010-2011
QUIZ- I (CLOSED BOOK)

Course No.: BIOT C332 03.11.10 Maximum Marks: 08
Course Title: Genetics Maximum Time: 20 minutes

Q1. Name any two unusual Bases present in a t-RNA. [1M]

Q2. What is the role of IF3 in translation? [1M]

Q3. What is molecular mimicry? [2M]

Q4. Define: a. Mutation [1M]

b. Transition Mutation [1M]

Q5. Give any two examples of any two chemical mutagens and mention their action. [2M]