

**CSE7350/5350****Review Quiz****Aug 28, 1999****(Sample Questions)****Discrete Mathematics/Data  
Structures****David W. Matula**

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**Part A( 60 Minutes) CLOSED BOOK**

**A1(2 points each)** Give one or two sentence descriptions of each of the following terms from discrete mathematics and /or data structures in the space provided.

1. Stack An abstract data type which serves as a collection of data. A stack is used by pushing data into the structure and then popping data off.

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2. One-to-one mapping refers to the concept of having a system in which each item/ input has linked to exactly one associated item/output

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3. Binary search tree is a data structure composed of sorted nodes which may have, at most, two children nodes. When traversing a BST, moving to the left of a node moves to a node with a lesser value than the current node, and moving to the right moves to a node with a greater value

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4. Transitive relation refers to the ideology where in a set of data, if an item 'a' is related to item 'b' and item 'b' is related to item 'c', then 'a' is also related to 'c'

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5. Hash table is a data structure which utilizes a hash function to compute the array index for a given key's value by hashing the key

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6. Asymptotic notation are languages that allow for the analysis of an algorithm's running time by identifying its behavior as the input size increases

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7. Monotonic function a function which is either entirely nonincreasing or nondecreasing. This function's derivative does not change sign.

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**A2. (2 points each):** For each of the description below give the notation that corresponds as shown in the example.

0. (Example) The product  $1 \times 2 \times 3 \times 4 \times \dots \times n$   $n!$

1. The sum of  $y_1 + y_2 + y_3 + \dots + y_n$

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$\sum y_n$

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2. The cartesian product of sets A and B

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$A \times B$

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3. The least integer greater than or equal to x

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$\lceil x \rceil$

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4. x is an element of set X

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$x \in X$

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5. Set A union set B

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$A \cup B$

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6. Power set of set A

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$P(A)$

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7. p implies q

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$p \rightarrow q$

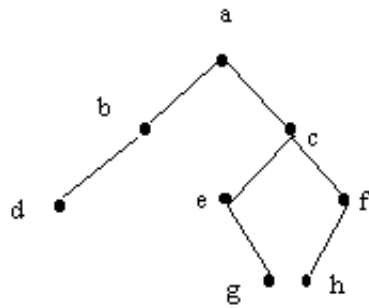
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**A3 (16 points):** Fill in the time and space complexity for each of the following sorting methods as shown for bubble sort.

For space complexity indicate either that the solution is "in place" or indicate how much space is needed (e.g.  $2n + O(1)$ ).

	Sorting Time WORST CASE	Complexity BEST CASE	[# comparison] AVERAGE CASE	SORTING SPACE COMPLEXITY
Bubble sort	$O(n^2)$	$O(n)$	$O(n^2)$	In -place
Insertion sort	$O(n^2)$	$O(n)$	$O(n^2)$	in place
Tree sort	$O(n^2)$	$O(n \log(n))$	$O(n \log(n))$	$O(n)$
Binary search tree with inorder traversal sort	$O(\log(n))$	$O(n \log(n))$	$O(n \log(n))$	$O(n)$
Heap Sort	$O(n \log(n))$	$O(n \log(n))$	$O(n \log(n))$	in place

**A4. (12 points)** Give the following traversals for the following binary tree.



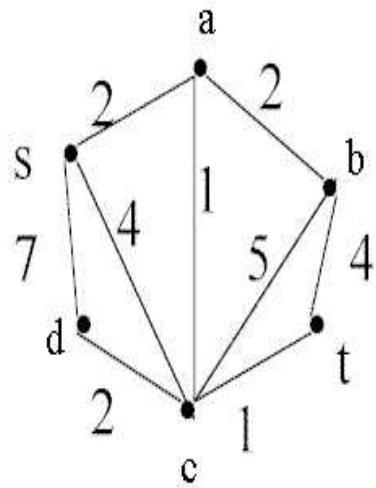
PRE-ORDER \_\_\_\_\_ a, b, d, c, e, g, f, h

IN-ORDER \_\_\_\_\_ d, b, a, e, g, c, h, f

POST-ORDER \_\_\_\_\_ d, b, g, e, h, f, c, a

**A5, (12 points)** For the network diagram and the matrix below determine the corresponding solutions. If no solution exists, fill in with "U".

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s	a	b	c	d	e	t	
0	6	0	4	0	0	7	s
	0	2	3	5	2	1	a
		0	1	6	4	0	b
			0	2	3	1	c
				0	8	5	d
					0	0	e
						0	t

Minimum  
weight of  
spanning  
tree

Minimum  
distance of  
traveling

Salesperson  
tour

Shortest  
distance  
from 's' to  
't'

