CS 3520: Algorithms

Homework 5

**Due Date: Wednesday, April 3, 2019 at beginning of class**

***Please write legibly. Show your steps to receive partial credit.***

1. (25 points) Use Gaussian elimination to solve the following system. Write down your steps to receive credit. You must follow the procedure of the Gaussian elimination algorithm. A solution with correct answers for the unknowns but not from the correct procedure may receive no credit.

1 1 1 4 1 1 1 4

1 -1 2 1 → 0 -2 1 -3 row2 – (1)\*row1

2 1 1 5 0 -1 -1 -3 row3 – (2)\*row1

↓

1 1 1 4

0 -2 1 -3 row3-(1/2)\*row2

0 -1 -1 -3

↓

1. 1 1 4

0 -2 1 -3

0 0 -3/2 -3/2

↓

-3/2z = -3/2 => z = 1

-2y +1 = -2 => y = 2

x + 2 + 1 = 4 => x = 1

1. (25 points) Construct an AVL tree by inserting each of the following numbers to an empty tree in their given order: 2, 5, 8, 7, 9, 6. Draw the result tree after each insertion.

2 255 5 7

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5 28 2 82 8 5 8

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7 7 9 2 6 9

1. (25 points) Construct a 2-3 tree by inserting each of the following numbers to an empty tree in their given order: 4, 18, 5, 17, 23, 2, 9. Draw the result tree after each number is inserted.

4 (4, 18) 5 5 (5, 18) (5, 18) (5, 18)

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4 18 4 (17, 18) 4 17 23 (2, 4) 17 23 (2, 4) (9, 17) 23

1. (25 points) Sort the list of numbers in increasing order by Heapsort: 4, 18, 5, 17, 23, 2, 9. List the heap after the heap is constructed and before each maximum is deleted from the root. Underline the numbers that have been sorted in each step.

Heap construction:

4, 18, 5, 17, 23, 2, 9

4, 18, 9, 17, 23, 2, 5

4, 23, 9, 17, 18, 2, 5

23, 4, 9, 17, 18, 2, 5

23, 18, 9, 17, 4, 2, 5

Root Removal:

23, 18, 9, 17, 4, 2, 5

5, 18, 9, 17, 4, 2 | 23

18, 5, 9, 17, 4, 2 | 23

18, 17, 9, 5, 4, 2 | 23

2, 17, 9, 5, 4 | 18, 23

17, 2, 9, 5, 4 | 18, 23

17, 5, 9, 2, 4 | 18, 23

4, 5, 9, 2 | 17, 18, 23

9, 5, 4, 2 | 17, 18, 23

2, 5, 4 | 9, 17, 18, 23

5, 2, 4 | 9, 17, 18, 23

4, 2 | 5, 9, 17, 18, 23

2 | 4, 5, 9, 17, 18, 23