Started on	Sunday, 19 September 2021, 9:15 AM
State	Finished
Completed on	Sunday, 19 September 2021, 9:46 AM
Time taken	30 mins 44 secs
Marks	5.00/5.00
Grade	**10.00** out of 10.00 (**100**%)

Question 1

Correct

Mark 1.00 out of 1.00

Given $g(n)$ and $h(n)$, define $f(n)$ as follows.

```
1: void f (int n){
2:   c = 1;
3:   j = 3;
4:   for i = 1 to n {
5:       print g(i);
6:       if (i == c)
7:         then {
8:              print h(i);
9:              c = c+j;
10:              j=j+2;}}}
```

Calculate the time complexity of $f(n)$ in big-theta notation. It is given that the time taken by $g(i)$ is $\sqrt{i}$ units and that by $h(i)$ is i^2 units. Assume that: assignments, `for` statements, `print` statements, mathematical operations and comparisons take 1 unit of time.

Select one or more:

- [ ] a. $\Theta(n * log(n))$
- [ ] b. $\Theta(n^{5/4})$
- [ ] c. $\Theta(\sqrt{n})$
- [ ] d. $\Theta(n^{3/2} + n^2)$
- [ ] e. $\Theta(\sqrt{n} * log(n))$
- [x] f. $\Theta(n^{5/2})$
- [ ] g. $\Theta(n + log(n))$
- [ ] h. $\Theta(n^2)$
- [ ] i. $\Theta(n * log(n) + \sqrt{n})$

- [ ] j. $\Theta(n^{3/2})$
- [ ] k. $\Theta(n)$
- [x] l. $\Theta(n^{5/2} + n^{3/2})$
- [ ] m. $\Theta(n^{3/2} * log(n))$

The correct answers are: $\Theta(n^{5/2})$

, $\Theta(n^{5/2} + n^{3/2})$

Question 2

Correct

Mark 1.00 out of 1.00

What will be the final state of a min-heap (implemented using an array) if the following 7 elements are inserted in order: 7, 0, 8, 5, 13, 17, 14. Assume that the heap was empty before inserting these elements.

Select one:

- a. [0, 8, 5, 17, 14, 7, 13]
- b. [0, 7, 5, 17, 8, 14, 13]
- c. [0, 8, 5, 13, 14, 17, 7]
- d. [0, 5, 8, 17, 7, 14, 13]
- e. [0, 5, 8, 7, 13, 17, 14] ✓
- f. [0, 8, 5, 14, 13, 7, 17]
- g. [0, 5, 13, 8, 7, 17, 14]
- h. [0, 7, 5, 17, 13, 14, 8]
- i. [0, 5, 7, 8, 14, 13, 17]
- j. [0, 7, 5, 17, 14, 8, 13]

The correct answer is: [0, 5, 8, 7, 13, 17, 14]

Question 3

Correct

Mark 1.00 out of 1.00

Consider a Merkle tree with 8 integer documents. Assume that the hash function used to calculate the digest at each node N is f(a,b) = a*3 + b (mod. 17) where a and b are the digests (or values for the leaves) of the left and right children of N respectively. Calculate the digest at the root node if the documents (leaves) in order are [15, 12, 6, 18, 7, 9, 13, 17].

Select one:

- a. 0
- b. 8
- c. 14
- d. 16
- e. 11
- f. 12
- g. 9
- h. 10
- i. 2 ✓
- j. 1
- k. 6
- l. 4
- m. 13
- n. 15
- o. 3
- p. 7
- q. 5

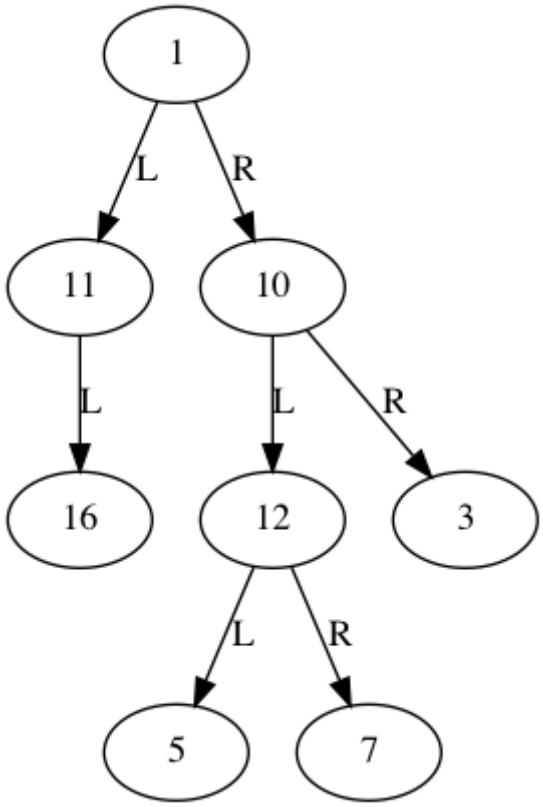
The correct answer is: 2

Question 4

Correct

Mark 1.00 out of 1.00

For the given binary tree, choose the options corresponding to the correct pre-order, in-order and post-order traversals. L and R denote the left and right child of a node respectively.



Select one or more:

- [x] a. In-order traversal: 16, 11, 1, 5, 12, 7, 10, 3 ✓
- [ ] b. In-order traversal: 5, 10, 11, 3, 12, 7, 16, 1
- [ ] c. Post-order traversal: 5, 7, 10, 11, 12, 16, 3, 1
- [ ] d. Post-order traversal: 16, 12, 3, 11, 1, 7, 5, 10
- [ ] e. In-order traversal: 16, 12, 10, 5, 1, 3, 7, 11
- [x] f. Pre-order traversal: 1, 11, 16, 10, 12, 5, 7, 3 ✓
- [ ] g. Pre-order traversal: 12, 5, 1, 16, 3, 10, 7, 11
- [ ] h. Pre-order traversal: 12, 5, 1, 16, 10, 7, 11, 3
- [ ] i. Pre-order traversal: 1, 11, 5, 3, 16, 10, 7, 12
- [ ] j. Post-order traversal: 1, 7, 10, 5, 12, 3, 16, 11
- [ ] k. In-order traversal: 16, 7, 5, 1, 3, 10, 11, 12
- [x] l. Post-order traversal: 16, 11, 5, 7, 12, 3, 10, 1 ✓
- [ ] m. Post-order traversal: 16, 7, 1, 3, 11, 12, 5, 10
- [ ] n. In-order traversal: 16, 12, 3, 10, 11, 1, 5, 7
- [ ] o. Pre-order traversal: 12, 1, 16, 10, 3, 5, 11, 7

The correct answers are: Pre-order traversal: 1, 11, 16, 10, 12, 5, 7, 3, In-order traversal: 16, 11, 1, 5, 12, 7, 10, 3, Post-order traversal: 16, 11, 5, 7, 12, 3, 10, 1

Question 5

Correct

Mark 1.00 out of 1.00

In this question we look at an open addressing scheme called cuckoo hashing. The set of keys we are trying to store is a subset of the natural numbers and we have a hash table T of size n. We are given two hash functions h1 and h2 which map all natural numbers to the set {0, 1, . . . , n−1}. In order to place a newly inserted key x into the table we do the following:
1. Compute l1 = h1(x).
2. If T[l1] is free then store x in T[l1] and exit, else
3. Compute l2 = h2(x).
4. If T[l2] is free then store x in T[l2] and exit else if y is currently stored in T[l2]. Remove y from T[l2] and store x there.
5. Now we need to find an alternate position for y. If l2 was h1(y) then compute l3 = h2(y) and go to step 4 else if l2 was h2(y) then compute l3 = h1(y) and go to step 4. The fifth time we have to go to step 4 we assume a cycle has occured and an exception is thrown declaring the insertion unsuccessful.

Now, consider a hash table with 5 elements already inserted:
[49, 69, 89, __, __, __, __, __, __, 58, 18]
What is the state of the table after you insert keys 55 and 56 if h1(x)=(5x + 8) mod 11, and h2(x)=(1x + 6) mod 11?
In case you detect a cycle (i.e. you throw an exception and abort the insertion) please show the state of the hashtable at the 5th time the “go to” statement is executed.

Select one or more:

- [ ] a. State after inserting 55: [18, 55, 69, __, __, __, __, __, 58, 49, 89]
- [ ] b. State after inserting 56: [18, 55, 69, __, __, __, 56, __, 58, 49, 89]
- [ ] c. State after inserting 55: [49, 69, 89, __, __, __, __, 55, __, 58, 18]
- [ ] d. State after inserting 56: [69, 89, 18, __, __, __, __, 55, 49, 58, 56]
- [x] e. State after inserting 55: [49, 69, 89, __, __, __, __, __, 55, 58, 18] ✓
- [ ] f. State after inserting 56: [49, 69, 89, __, __, __, __, 55, 56, 58, 18]
- [ ] g. State after inserting 56: [49, 69, 89, 56, __, __, __, __, 55, 58, 18]
- [x] h. State after inserting 56: [49, 69, 89, __, __, __, __, 56, 55, 58, 18] ✓
- [ ] i. State after inserting 55: [49, 69, 89, 55, __, __, __, __, __, 58, 18]
- [ ] j. State after inserting 55: [49, 69, 89, __, __, __, 55, __, __, 58, 18]

The correct answers are: State after inserting 55: [49, 69, 89, __, __, __, __, __, 55, 58, 18], State after inserting 56: [49, 69, 89, __, __, __, __, 56, 55, 58, 18]

◀ Lab Submission 3 Friday 17.9.2021

Jump to...

Dummy Minor Part 1 ▶