KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.E./B.Sc.
Year : II
Course : COMP 202
Semester : I
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date : 04 JUL 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Mark [X] in the most appropriate answer from the alternatives given. All symbols have their usual meanings.

1. What is the time complexity of following code?

```
int a = 0;
for (i = 0; i < n; i++) {
  for (j = n; j > i; j--) {
        a = a + i + j;
  }
}
```

[ ] O(n) [ ] O(n × log(n)) [ ] O(n × Sqrt(n)) [ ] O(n × n)

2. Which is the postfix expression for the following infix expression?

A + B × (C + D)/F + D × E

[ ] AB + CD + × F/D + E× [ ] ABCD +× F/+ DE×+
[ ] A × B + CD/F × DE++ [ ] A +×BCD/F × DE++

3. Which of the following is essential for efficiently converting an infix expression to its postfix form?

[ ] An operator stack [ ] An operand stack
[ ] An operand stack and an operator stack [ ] A parse tree

4. The end from which an element gets deleted from a queue is called the_____.

[ ] front [ ] rear [ ] top [ ] bottom

5. Consider the linked list of n elements. What is the time taken to insert an element after an element pointed by some pointer?

[ ] O(1) [ ] $O(\log_2 n)$ [ ] O(n) [ ] $O(n\log_2 n)$

6. Which of the following traversal techniques lists the nodes of a BST in ascending order?

[ ] Postorder [ ] Inorder [ ] Preorder [ ] All of them

7. A binary tree has a height of 5. What is the minimum number of nodes it can have?

[ ] 31 [ ] 15 [ ] 5 [ ] 16

8. A binary tree is generated by inserting an in order as 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24. The number of nodes in the left and right subtree, respectively is given by

[ ] (4, 7) [ ] (7, 4) [ ] (8, 3) [ ] (3, 8)

9. A balanced tree is a tree having height difference of its left and right subtree equals to

[ ] 0 [ ] 1 [ ] 0 or 1 [ ] 2

10. In a max-heap tree
[ ] Value in a node is greater than every value in children of it.
[ ] Value in a node is greater than every value in left subtree and smaller than right sub tree
[ ] Both values in a nodes is greater than every value in children of it and values in a node is greater than every value in left sub tree and smaller than right sub tree
[ ] Value in a node is smaller than every value in children of it

11. What is the time complexity of in order traversal of binary search tree?
[ ] O(n) [ ] O(n log n) [ ] O(n*n) [ ] O(log n)

12. Which of the following sorting algorithm use divide and conquer approach?
[ ] Heap sort [ ] Selection sort [ ] Insertion sort [ ] Quick sort

13. Which statement is **FALSE** about binary trees?
[ ] Every binary tree has at least one node. [ ] Every non-empty tree has exactly one root node.
[ ] Every node has at most two children. [ ] Every non-root node has exactly one parent.

14. The five items: A, B, C, D and E are pushed in a stack, one after the other starting from A. The stack is popped four times and each element is inserted in a queue. Then two elements are deleted from the queue and pushed back on the stack. Now one item is popped from the stack. The popped item is
[ ] E [ ] B [ ] C [ ] D

15. If the first node contains the address of last node and last node holds the address of the first node. Such a concept represents
[ ] Singly circular linked list [ ] queue
[ ] doubly circular linked list [ ] doubly linked list

16. What is the best definition of a collision in a hash table?
[ ] Two entries are identical except for their keys.
[ ] Two entries with different data have the exact same key.
[ ] Two entries with different keys have the same exact hash value.
[ ] Two entries with the exact same key have different hash values.

17. A hash function is defined as h (k) = k mod 7, with linear probe function p (k) = h (k) + i, is used to insert keys 42, 38, 72, 48, 98, 11, 2, into a table indexed from 0 to 6. What will be the location of key 2?
[ ] 3 [ ] 4 [ ] 5 [ ] 6

18. What is common in three different types of traversals (Inorder, Preorder and Postorder)?
[ ] Root is visited before right subtree
[ ] Left subtree is always visited before right subtree
[ ] Root is visited after left subtree
[ ] There is no common procedure in all types of traversals

19. Which of the following is useful in traversing a given graph by depth first Search (DFS)?
[ ] STACKS [ ] REAR [ ] FRONT [ ] QUEUEs

20. In the deletion operation of max heap, the root is replaced by
[ ] next available value in the left sub-tree. [ ] next available value in the right sub-tree.
[ ] any random value from the heap. [ ] last element of the last level.

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04 JUL 2023

Level : B.E./B.Sc.
Year : II
Time : 2 hrs. 30 mins.

Course : COMP 202
Semester : I
F. M. : 40

SECTION "B"

[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What is asymptotic analysis, and why is it crucial in algorithm analysis? Please provide a clear explanation of the purpose and significance of Big-O notation in evaluating algorithm efficiency, supported by a relevant example. [2+2]

2. Convert the following infix expression to a postfix expression using a stack. Show the content of the stack at each step of the conversion process. [2+2]

   T + (U * W) / ((X + Y) * Z)

3. Explain the process of element insertion and removal in an array-based circular queue. Support your explanation with suitable diagrams, as needed.

4. What are the fundamental properties of a binary tree? Provide a comprehensive explanation of each property.

5. How does the worst-case time complexity of binary search tree operations differ between balanced and unbalanced binary search trees? Support your explanation with a suitable example.

6. Why is it generally discouraged to use an even number as a divisor in the Modulo-Division hashing method? Furthermore, explain the process of selecting a suitable divisor (D) for a given bucket size (b), and support your explanation with a relevant example.

7. Write short notes on (*ANY TWO*) [2+2]
   a. Doubly Circular Linked List
   b. Almost complete binary tree
   c. Adjacency Matrix

SECTION "C"

[2 Q. × 8 =16 marks]

Attempt *ANY TWO* questions.

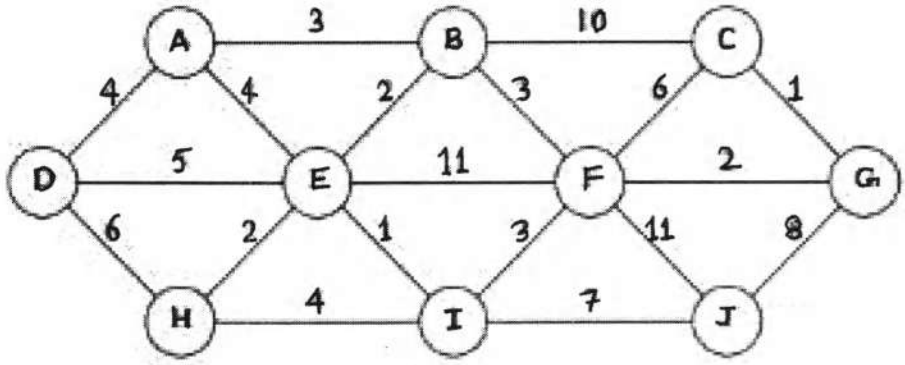
8. a. Describe and analyze the different cases that arise when deleting a node from a binary search tree (BST). Provide a detailed explanation of each case, supported by suitable examples and their corresponding visual representations. [6]

   b. What are the key properties of a heap in a binary tree? [2]

9. a. Describe the implementation of quicksort algorithm and analyze its running time in various scenarios, including sorted and random inputs. Support your explanation with a suitable example. [4]

b. Sort the sequence 3, 1, 4, 7, 9, 2, 6, 5 using merge sort. What is the time complexity of merge sort in the case where all elements are equal? Provide an explanation for your answer. [4]

10. a. Find the minimum spanning tree for the given graph using Prim's and Kruskal's algorithms, considering node A as the source node. [4]



b. On the basis of efficient queries operations, which type of graph representation would be most suitable for a complete graph? Justify your answer with relevant explanations and reasoning. [4]

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Level : B.Sc.
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Time: 30 mins.

F. M. : 20

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Date : 06 JUL 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Mark [X] in the most appropriate option.

1. Which one is the largest and most important class of minerals and make up approximately 90 percent of Earth's crust.
[ ] Carbonate Mineral [ ] Silicate Minerals
[ ] Heavy Minerals [ ] Sulphate Minerals

2. The term used to describe the movement of groundwater from the subsurface to the surface.
[ ] Groundwater surcharge [ ] Groundwater recharge
[ ] Surface water recharge [ ] Groundwater discharge

3. _____period was ended with a massive meteorite impact that caused a mass extinction, wiping out the dinosaurs and up to 80% of life on Earth.
[ ] Terrasic [ ] Cretaceous [ ] Jurrasic [ ] Moicene

4. _____ is known as the softest mineral on Earth - so soft that you can scratch it with your fingernail.
[ ] Calcite [ ] Talc [ ] Magnesite [ ] gypsum

5. An earthquake is what happens when two blocks of the earth suddenly slip past one another. The surface where they slip is called the _____ plane.
[ ] fracture or fracture [ ] fault or fault
[ ] joint or joint [ ] fold or fold

6. _____ is a sedimentary rock that looks like concrete.
[ ] Granite [ ] Marble [ ] Phyllite [ ] Conglomerate

7. Retrograde" refers mineral changes that take place during _____ in temperature.
[ ] increase [ ] decrease [ ] steady [ ] constant

8. Refers to boundary of unsaturated and saturated zones.
[ ] Table of Water [ ] Pressure line [ ] Water Table [ ] Recharge boundary

9. _____ is a brittle-fracture surface in rocks along which little or no displacement has occurred.
[ ] Joint [ ] Fold [ ] Fault [ ] Cleavage

10. _____ is the study of rocks - igneous, metamorphic, and sedimentary - and the processes that form and transform them.
[ ] Petrology [ ] Geomorphology [ ] Metrology [ ] Sedimentology

11. The focus is the actual point at which an earthquake occurs and the point from which body waves of an earthquake ultimately originate and this is also known as by another word " _____".
[ ] Centrepoint [ ] Epicenter [ ] Hypocentre [ ] Metacentre

12. _____ is molten or partially molten rock that has been expelled from the interior of a terrestrial planet (such as Earth).
[ ] Magma [ ] Lava [ ] Batholith [ ] Sill

13. _____ is the very slow downslope movement of material under gravity.
[ ] Topple [ ] Fall [ ] Slide [ ] Creep

14. _____ is a sub-horizontal sheet intrusion of molten or solidified magma.
[ ] Pike [ ] Dyke [ ] Sill [ ] Chamber

15. _____ is a coarse-grained (phaneritic) intrusive igneous rock composed mostly of quartz, alkali feldspar, and plagioclase.
[ ] Granite [ ] Gneiss [ ] Slate [ ] Schist

16. A meandering stream has a _____ channel that winds snakelike through its valley.
[ ] multiple [ ] double [ ] zero [ ] single

17. Point bar is _____ landforms forms due to running water.
[ ] erosional [ ] weathering [ ] depositional [ ] glacial

18. _____ lakes are the remains of the bend in the river.
[ ] Dead [ ] Oxbow [ ] Active [ ] Salt

19. _____ is a weak, ductile layer of the mantle, 100 km beneath the Earth surface; deforms to accommodate the motions of the overlying plates
[ ] Lithosphere [ ] Chromosphere [ ] Asthenosphere [ ] Hemisphere

20. _____ energy is heat energy from the earth.
[ ] Geothermal [ ] Solvothermal [ ] Stenothermal [ ] Mesothermal

SECTION "B"

[20 Q. × 0.5 = 10 marks]

Mark "T" for true and "F" for false

21. A major difference between geologists and most other scientists is their concept of formation. [ ]

22. A "long" time may not be important unless it is greater than 5 million years. [ ]

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23. Absolute age dating deals with assigning actual dates (in years before the present) to rocks or geological events. [ ]

24. Rock tectonics is a scientific theory that explains how major landforms are created as a result of Earth's subterranean movements. [ ]

25. Metamorphic Grade refers to the intensity of magmatism. [ ]

26. In a reverse or thrust fault, the hanging wall has moved down relative to the footwall. [ ]

27. Earthquakes are the result of sudden movement along folds within the Earth. [ ]

28. The word artesian, properly used, refers to situations where the water is confined under pressure below layers of relatively impermeable rock. [ ]

29. Volcano shaking or trembling of the earth caused by movement along a folds. [ ]

30. Pillow Basalts is a basaltic lava extruded beneath the water, characterized by glassy pillows filled with crystalline basalt. [ ]

31. Requirements for Isotopic Dating: Closed system, decay rate constant, Initial concentration of daughter is known (zero is best). [ ]

32. Erosion is breaking down rocks, soil, and minerals as well as wood and artificial materials by contacting the atmosphere, water, and biological organisms of the Earth. [ ]

33. Debris flows are geological phenomena in which water-laden masses of soil and fragmented rock rush down mountainsides. [ ]

34. weathering, disintegration or alteration of rock in its natural or original position at or near the Earth's surface through physical, chemical, and biological processes induced or modified by wind, water, and climate. [ ]

35. The study of structure and evolution of landforms and processes of earth's surfaces is called geomorphology. [ ]

36. Mantle is divided into six parts. [ ]

37. The most destructive seismic wave is P-wave. [ ]

38. Metamorphic rocks are derived from slow cooling of magma beneath the surface of the earth. [ ]

39. An aquifer is a rock formation which is porous and essentially impermeable. [ ]

40. Metamorphic facies are characteristic of particular tectonic environments and will have certain minerals that are indicative of those conditions. [ ]