**Unit III- Balanced Trees**

**Session 1:**

**Time :20 minutes**

**Topic:** AVL Trees

**Activity:** Board activity

**Description:** AVL Trees concept was highlighted on the board

The points were

1. AVL Trees- Binary search tree which satisfies the balancing condition
2. Rotations
3. LL rotation
4. RR rotation.

**Time: 20 minutes**

**Topic:** AVL operation-single rotation

**Activity:** Presentation Videos

**Description:**

Tree concept was explained through PPT slides.

The concepts was highlighted on the board

1. Single LL rotation
2. Single RR rotation

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Question and Answer

1. What is AVL tree?
2. What is balancing condition for AVL tree?
3. What is single rotation?
4. What is LL rotation?
5. What is RR rotation?
6. Is Avl tree is binary search tree or not?
7. Is AVL tree is binary tree or not?

**Website Links:**

1. en.wikipedia.org/wiki/AVL\_**Tree**\_(**data\_structure**
2. pages.cs.wisc.edu/~paton/readings/liblitVersion/**AVL**-**Tree**-Rotations.pdf‎
3. www.cs.washington.edu/education/courses/cse373/04wi/.../lecture08.ppt

**Session 2:**

**Time :10 minutes**

**Topic:** Recap: AVL Trees

**Activity:** Quiz

**Description:** Questions were asked between 3 teams of learners. The question were

1. What is AVL tree?
2. What is balancing condition for AVL tree?
3. What is single rotation?
4. What is LL rotation?
5. What is RR rotation?
6. Is Avl tree is binary search tree or not?
7. Is AVL tree is binary tree or not?

**Time: 30 minutes**

**Topic:** Double rotation

**Activity:** Writing Board

**Description:**

**Double rotation are classified as follows**

**LR rotation**

**RL rotation**

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Learner led activity

Various trees were given to the students and learners are facilitated to rotate the trees to obtained balanced AVL tree

Insert 1,3,7,8,9,11,13 into AVL tree and apply possible rotation.

**Website Links:**

1. www.academic.marist.edu/~jzbv/ads/**AVLTrees**.htm‎
2. www.cs.cmu.edu/~wlovas/15122-r11/lectures/18-**avl**.pdf‎
3. pages.cs.wisc.edu/~paton/readings/liblitVersion/**AVL**-**Tree**-Rotations.pdf

**Session 3:**

**Time :20 minutes**

**Topic:** Splay trees

**Activity:** Presentation Unspoken words

**Description:** Splay Trees concept was highlighted on the board

The points were

1. Guarantees any M consecutive tree operations starting from an emprty tree take O(M log N) time.
2. Splaying

**Time: 20 minutes**

**Topic:** Simple idea splaying

**Activity:** Presentation and unspoken words

**Description:PPT slides were presented.**

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Recall by keywords

1. Splay tree
2. Guarantees any M consecutive tree operations starting from an emprty tree take O(M log N) time.
3. Splaying
4. LL rotate
5. RR rotate
6. LR rotate
7. RL rotate

**Website Links:**

1.en.wikipedia.org/wiki/**Splay**\_**tree**‎

2. www.cs.unc.edu/~plaisted/comp750/08-**splay**.ppt‎

3.digital.cs.usu.edu/~allan/DS/Notes/Ch22.pdf‎

4.www.youtube.com/watch?v=G5QIXywcJlY‎

**Session 4:**

**Time :20 minutes**

**Topic:** B-Trees

**Activity:** Board activity

**Description:** B Trees concept was highlighted on the board

The points were

1. B Trees- each node occupies a disk block and interior nodes stores only keys .
2. 2-3 trees

**Time: 20 minutes**

**Topic:** Implementation of B Trees

**Activity:** Presentation and Discussion

**Description:**

B Tree concept was explained through PPT slides.

1. Data items are stored at leaves
2. Non leaf nodes stores upto M-1 keys to guide the searching, key I,represents the smallest key in subtree
3. Root is either a leaf or has between two and M children.

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Recapping

1. What is B tree?
2. B Trees- each node occupies a disk block and interior nodes stores only keys .
3. 2-3 trees
4. Data items are stored at leaves
5. Non leaf nodes stores upto M-1 keys to guide the searching, key I,represents the smallest key in subtree
6. Root is either a leaf or has between two and M children.

**Website Links:**

1. en.wikipedia.org/wiki/**B**-**tree**‎
2. [www.youtube.com/watch?v=HZRPa0kMOZE](http://www.youtube.com/watch?v=HZRPa0kMOZE)
3. www.youtube.com/watch?v=coRJrcIYbF4‎

**Session 5:**

**Time :20 minutes**

**Topic:** Heap

**Activity:** Brainstorming

**Description:** Trees concept was highlighted on the board

The points were

1. Trees- collection of Nodes
2. Root, children and leaves, siblings
3. Definition of Path, length ,depth,Height,degree and level of the tree.

**Time: 20 minutes**

**Topic:** Model of Heap

**Activity:** Analogy

**Description:**

**Time: 20 minutes**

**Topic:** Simple Implementation

**Activity:** Presentation Unspoken words

**Time: 05 minutes**

**Topic:** Conclusion

**Activity:** Presentation

**Website Links:**

1. en.wikipedia.org/wiki/**Heap**\_(data\_structure)
2. en.wikipedia.org/wiki/**Heap**‎
3. en.wikipedia.org/wiki/Binary\_**heap**‎
4. webdocs.cs.ualberta.ca/~holte/T26/**heap**-ops.html‎
5. www.columbia.edu/~cs2035/courses/csor4231.F11/**heap**-invariant.pdf‎

**Session 6:**

**Time :05minutes**

**Topic:** Binary Heap

**Activity:** Board activity

**Description:** Trees concept was highlighted on the board

The points were

1. Trees- collection of Nodes
2. Root, children and leaves, siblings
3. Definition of Path, length ,depth,Height,degree and level of the tree.

**Time: 20 minutes**

**Topic:** Structure Property

**Activity:** Presentation and Board activity

**Description:**

**Time: 20 minutes**

**Topic:** Heap order Property

**Activity:** Presentation and Board activity

**Description:**

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Learner Led activit

**Website Links:**

1. en.wikipedia.org/wiki/**Heap**\_(data\_structure)
2. en.wikipedia.org/wiki/**Heap**‎
3. en.wikipedia.org/wiki/Binary\_**heap**‎
4. webdocs.cs.ualberta.ca/~holte/T26/**heap**-ops.html‎
5. www.columbia.edu/~cs2035/courses/csor4231.F11/**heap**-invariant.pdf‎

**Session 7:**

**Time :20 minutes**

**Topic:** Recap: Binary Heap

**Activity:** Presentation and Board activity

**Description:** Trees concept was highlighted on the board

**Time: 20 minutes**

**Topic:** Basic Heap operations

**Activity:** Presentation and Board activity

**Description:**

Heap Tree concept was explained through PPT slides.

The property of heap

1. Structure order property
2. Heap order property

The concepts was highlighted on the board

1. Insert Heap
2. Delete Min

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Group Discussion

The students were grouped into 3 groups and they are discussed about the advantages and operations of Binary Heap over other trees. Points discussed were

1. A **binary heap** is a heap data structure created using a binary tree. It can be seen as a binary tree with two additional constraints:
* Structure order property
* Heap order property

Basic Heap operations

1.Insert

2. DeleteMin

Time to do insertion could be as much as O(log N), if element to be inserted is new minimum and is percolated all the way to the root.

**Website Links:**

1. www.cs.gsu.edu/~skarmakar/cs3410/slide21.ppt‎
2. www.cs.duke.edu/~reif/courses/alglectures/skiena.lectures/lecture4.pdf‎
3. courses.cs.vt.edu/cs2604/spring02/Notes/C07.**Heaps**.pdf‎
4. cs.anu.edu.au/~Alistair.Rendell/Teaching/apac.../**binary**\_**heaps**.xhtml

**Session 8:**

**Time: 20 minutes**

**Topic:** Binary Heap

**Activity:** Presentation andBoard activity

**Description:** Trees concept was highlighted on the board

Recap on Binary Heap properties

1. Structure property
2. Heap order property

**Time: 20 minutes**

**Topic:** Other Heap operations

**Activity:** Learner Led Presentation

**Description: Learners were allowed to present the topics.**

**1.Decreasekey**

**2.Increase Key**

**3.Leftist Heaps.**

**Time: 10 minutes**

**Topic:** Heap Sort(content Beyond syllabus)

**Activity:** Videos

**Description:**

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Show and tell



**Website Links:**

1. stackoverflow.com/.../what-does-it-actually-mean-by-**different**-**heap**-operations
2. www.eecs.wsu.edu/~ananth/CptS223/Lectures/**heaps**.pdf‎
3. www.cs.washington.edu/education/courses/cse373/01sp/Lect10.pdf‎

**Session 9:**

**Time :20 minutes**

**Topic:** Introduction

**Activity:** Writing Board

**Description:** Trees concept was highlighted on the board

**Time: 20 minutes**

**Topic:** Application of Binary Heaps

**Activity:** Presentation and Board activity

**Description:**

**Time: 10 minutes**

**Topic:** Conclusion

**Activity:** Word puzzle

**Website Links:**

1.