1. Insert Number to a Heap

Delete Number from a Heap

(Or Insert Number to a Binary Tree - Delete Numer from Binary Tree)

2. Hashing

Insert the following sequence of numbers 23, 46, 12, 21, 75, 5, 3

into a hash table of size 9 using h(x) = x%9 as a hash function. % means

Mod. Use Chaining with Linked List to avoid collision.

3. Chứng minh nếu 1 cây là cây black-red tree, thì nó ko có 1 nút đen, và chỉ có 1 con là nút đen.

4. Knapsack giống final exam khóa trước Question2.a

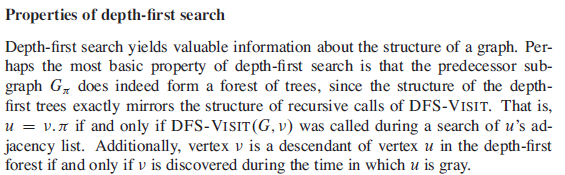
5. Question 3.b

6. Tính Running Time giống bài Graph, page 126 (Minimum Spanning Tree: Greedy Algorithms)

7. Chứng minh là nếu node A là parent của B nếu và chỉ nếu finish Time A > finish Time B && discovery Time A < Discovery Time B

8. Nếu 1 nút lúc discovery là Gray or White thì nó là nút cha (ko nhớ chính xác, nhưng câu này ở đâu đó trong slide or homework)

**Academic answer:** From page 606 of Introduction to algorithm book:



Short answer:

If v is discovered while u is gray, the recursive dfs function called upon u hasn't finished, it means that the dfs function called upon v is inside the dfs function called on u -> v is a descendant of u

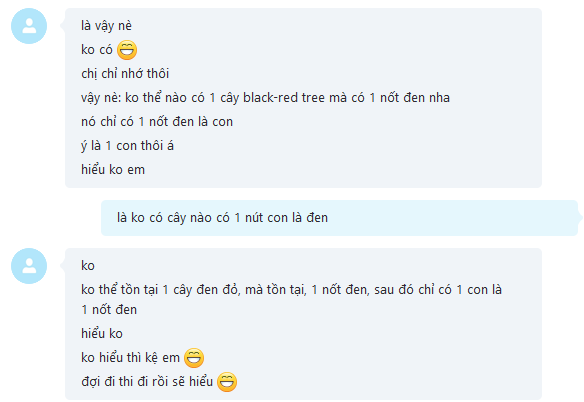
9, Question 4b trong exam khóa trước

10. Question 5

11. Big Data – Semantic and Natural Natural Language trong Searching today (ko nhớ chính xác)

12. NP Problem: Reduce 3CNF to independent Set

Câu 3



Question 3: If a black node has only one child that child must be a red leaf (why?)

A: Due to the rules there are limits on how unbalanced a Red Black tree may become. Then draw 1 root node (black) and new node must be red (use black height to prove that the tree become unbalance if new node is black)