**Question 1 Solution:**

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**Question 2 Solution:**

1. The candidate keys are

AB,BC,CD,AD

1. R is in 3NF BUT NOT IN BCNF
2. C->A and D->B. Both causes violations .So decompose into: AC,BCD but it does not preserve AB->C and AB->D and BCD is still not BCNF because D->B. So decompose further into : AC,BD,CD. We revive the lost functional dependencies by add ABC and ABD, these relations are not in BCNF form. Thus there is no BCNF decomposition

**Question 3 Solution:**

(i)

(a) The 5 nodes will be 15,16,23,26 and 40 inserted in the vacant spaces and 5th one should add a level to the existing tree. On deletion of the nodes from 40,26,23,16 and 15 resultd in the origibnal tree.

(c) The 4 nodes of distinct keys will be inserted in the vacant spaces whereas the insertion of 5th node resultd in the level increase of the tree.

**Question 4 Solution:**

(i) Cost is generally measured as total elapsed time for answering query Many factors contribute to time cost are disk accesses, CPU, or even network communication

(ii) (a)

1. Cost of checking all conditions via a table scan + filter:B(R) = 1000blockI/Os.

2. Cost of an index-scan for condition a= 1, followed by a filter:B(R)/V(R,a) =1000/20 = 50block I/Os.

3. Cost of an index-scan for condition b= 2, followed by a filter:T(R)/V(R,b) =5000/1000 = 5block I/Os.

4. Cost of an index-scan for condition d= 3, followed by a filter:T(R)/V(R,d) =5000/500 = 10block I/Os.

Thus,we select plan 3.

(b)

1. Cost of checking all conditions via a table scan + filter:B(R) = 1000blockI/Os.

2. Cost of an index-scan for condition a= 1, followed by a filter:B(R)/V(R,a) =1000/20 = 50block I/Os.

3. Cost of an index-scan for condition b= 2, followed by a filter:T(R)/V(R,b) =5000/1000 = 5block I/Os.

4. Cost of an index-scan for condition c<3, followed by a filter:T(R)/3 =5000/3 = 1667 block I/Os.

Thus,select the plan 3.

**Question 5 Solution:**

(a)

(i) It is serialized, view-serialized, not conflict serializable. It is recoverable and avoid cascading aborts. It is not strict

(ii)It is serializable and view seriializable, not conflict serializable and is recoverable.