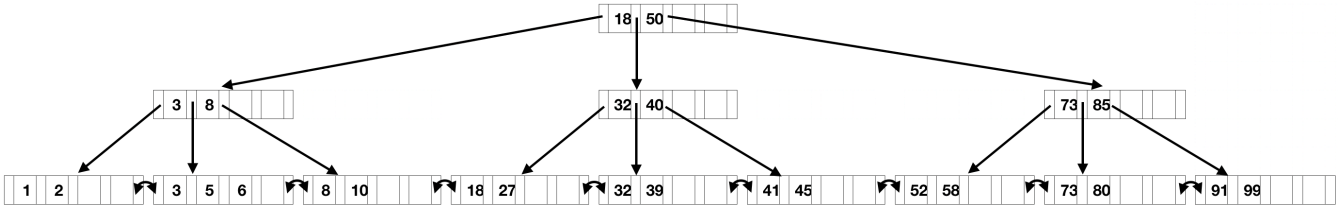
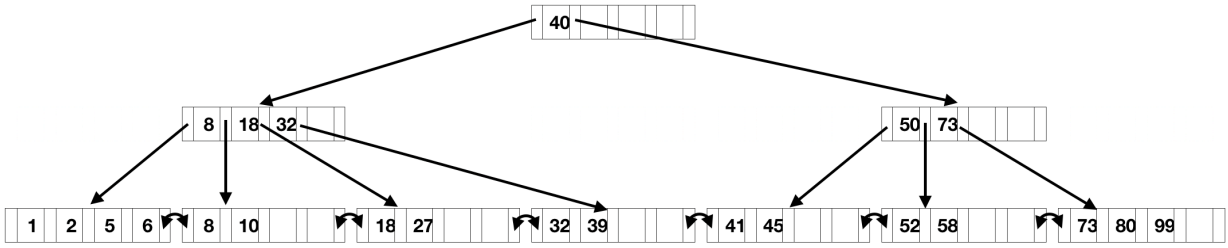
Question 1

1) 5*5*4 – 18 = 82

2)



3)



Question 2

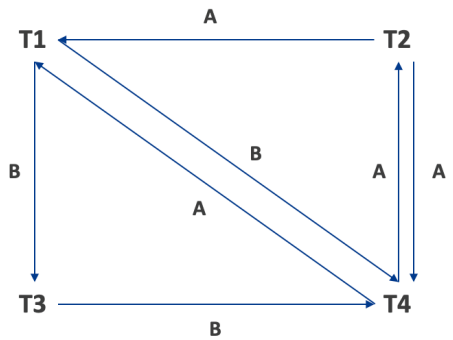
Clustered B+ tree index on attributes (R.a, R.b) gives the cheapest costs among the given approaches. The reasons are:

1) Clustered B+ tree performs better for range query as the data are sorted

2) It is an index-only plan; therefore, we can retrieve the results without accessing the data records

Question 3

1) Undo: T1, T4



2) No.

3) One possible solution is as below:

RL(*) stands for read_lock, WL(*) stands for write_lock and U(*) stands for unlock.

Time	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}
T_1									WL(B)	R(B)		
T_2	WL(A)	R(A)	W(A)	U(A)								
T_3					WL(B)	R(B)	W(B)	U(B)				
T_4											WL(A)	R(A)

Time	t_{13}	t_{14}	t_{15}	t_{16}
T_1	WL(A)	***Wait for A***	***Wait for A***	***Wait for A***
T_2				
T_3				
T_4		WL(B)	***Wait for B***	***Wait for B***

4) One possible solution is as below:

Time	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}
T_1	R(B)	R(A)	W(B)	W(A)								
T_2					R(A)	W(A)						
T_3							R(B)	W(B)				
T_4									R(A)	W(A)	R(B)	W(B)