Solution 1 a)

```
A ------ B
|        |
|        |
C ------ D
```

Step 1:

A   B   C   D

        No pruning possible in Step 1.

Step 2:

A   B   C   D

A-B   B-A   C-A   D-C
A-C   B-C   C-D   D-B

        Pruning Step : AB = min ($(A-B), $(B-A)) , and similarly for others

Step 3:

AB   BD   DC   CA

AB-C   BD-A   DC-A   CA-B
AB-D   BD-C   DC-B   CA-D

        Pruning Step : ABC = min ($(AB-C), $(CA-B)), and similarly for others

Step 4:

ABC   BDC   CDA   ADB

ABC-D   BDC-A   CDA-B   ADB-C

        Pruning Step : ABCD = min ($(ABC-D), $(BDC-A), $(CDA-B), $(ADB-C))

Solution 1b)
System R optimizer doesn't examine bushy joins and only looks for linear sequences. Bushy joins expand the cost of enumerating the search space considerably.

Solution 2) [2nd Pick - Total plans]
Assuming linear sequence means :   A --- B --- C --- D --- E

Step 1: # of L.A.P. trees with relations is : n
After pruning : n

Step 2: # of LAP trees with relations is : 2n - 2
After pruning : n-1

Step 2: # of LAP trees with relations is : 2(n-1) - 2
After pruning : n-2

Total number of plans = n + (2n-2) + (2(n-1)-2) + ….

$$= n + \sum_1^n 2x - 2$$
$$= n + (n^2 + n) - 2n$$
$$= n^2$$

Solution 3)

(a) B=3 or B=4
Index on 'B', as it has an index.
(b) B= 66 and C=12
Index on C or index on B, either of them.
(c) B>3 and C>77
No index. Full table scan happens.
(d) B=22 and A = 15
Index on B, as average number of tuples returned by B will be lesser than A
(e) D=44 and B>34
No index. Full table scan happens.

Solution 4)

select *
from a, b
where a.X = b.X or a.Y=b.Y

   Let J be (J1 and J2) , J1 => a.X = b.X and J2 => a.Y = b.Y

So, in case of OR, <u>cross product of the join streams</u> (J1 and J2) can be examined for System R algorithm.