The following table corresponds to an allocation problem:

	1	2	3	4
a	a_{11}	a_{12}	a_{13}	a_{14}
b	a_{21}	a_{22}	a_{23}	a_{24}
c	a_{31}	a_{32}	a_{33}	a_{34}
d	a_{41}	a_{42}	a_{43}	a_{44}

It is requested:

a) Generate 16 random numbers between 5 and 35.

```
a11: 30
a12: 12
a13: 27
a14: 5
a21: 10
a22: 23
a23: 19
a24: 30
a31: 13
a32: 7
a33: 24
a34: 22
a41: 9
a42: 6
a43: 25
a44: 23
```

b) Substitute the aij values for the generated numbers.

	1	2	3	4
A	30	12	27	5
B	10	23	19	30
C	13	7	24	22
D	9	6	25	23

c) Solve the corresponding allocation problem using branch and bound.

To carry out the branching and bounding we will go through an implicit tree in which the nodes correspond to partial assignments of agents to tasks. In the root of the tree there is no assignment. At each stage (tree level) one more agent is assigned. The possibilities for the first assignment would be:

A1 (30) **A2 (12)** **A3 (27)** **A4 (5)**

Each node calculates a level of the best solution (minimum cost) that could be obtained from that node.

A1 (30)	**A2 (12)**	**A3 (27)**	**A4 (5)**
D2+B3+A4	D1+B3+A4	D1+D2+A4	D1+D2+B3
6+19+5	9+19+5	9+6+5	9+6+19
Cost: 60	Cost: 45	Cost: 47	Cost: 39

The one with the best available elevation is chosen (A4) and the exploration is continued.

A4 (5)

D1+D2+B3

9+6+19

Cost: 39

A4 B1	**A4 B2**	**A4 B3**
5 10	**5 23**	**5 19**
D2+B3	D1+B3	D1+D2
6+19	9+19	9+6
Cost: 40	Cost: 56	Cost: 39

The one with the best available elevation is chosen (A4 B3) and the exploration is continued.

A4 B3

5 19

D1+D2

9+6

Cost: 39

A4 B3 C2 D1	**A4 B3 D2 C1**
5 19 7 9	**5 19 6 13**
Cost: 40	Cost: 43

The lower cost we can achieve is 40. We could explore the A4 B1 option but its lowest cost is 40, even when using twice B (B1 and B3), so the cost at the end will be higher.

All the other nodes are bounded because the initial cost is higher than 40.

Finally, we can conclude that the solution is **A4, B3, C2, D1.**