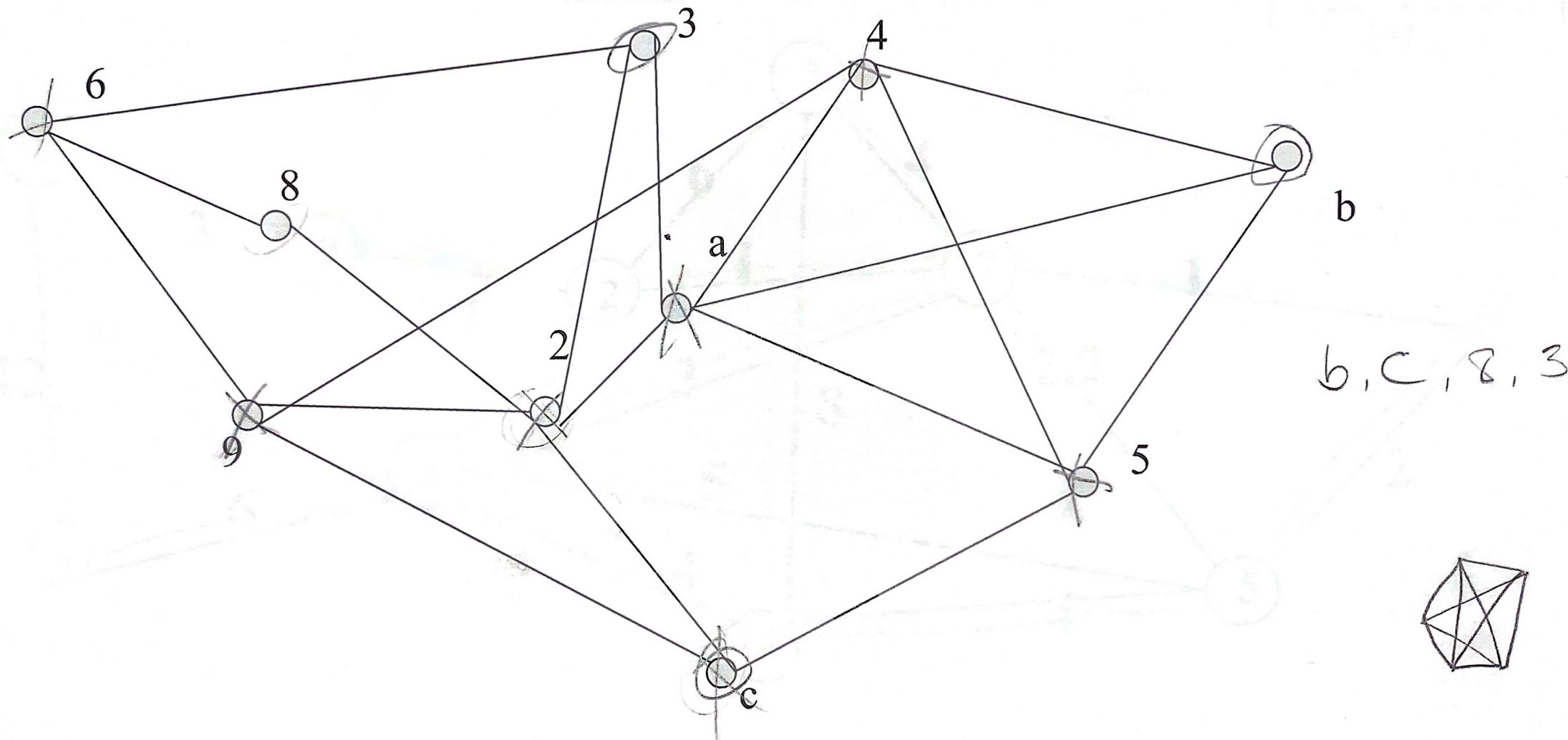


1. For minimum vertex cover problem in the following graph give

greedy solution = nodes 1, 4, 5, 6, a, 9

2-VC solution = nodes 2 3 4 5 6 8 9 c ab

Optimal solution = nodes 2 4 5 6 9 a



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For the following graph, find

Optimal TSP tour 1372986a451

length = 49

Double MST tour 15451729892737a6a71

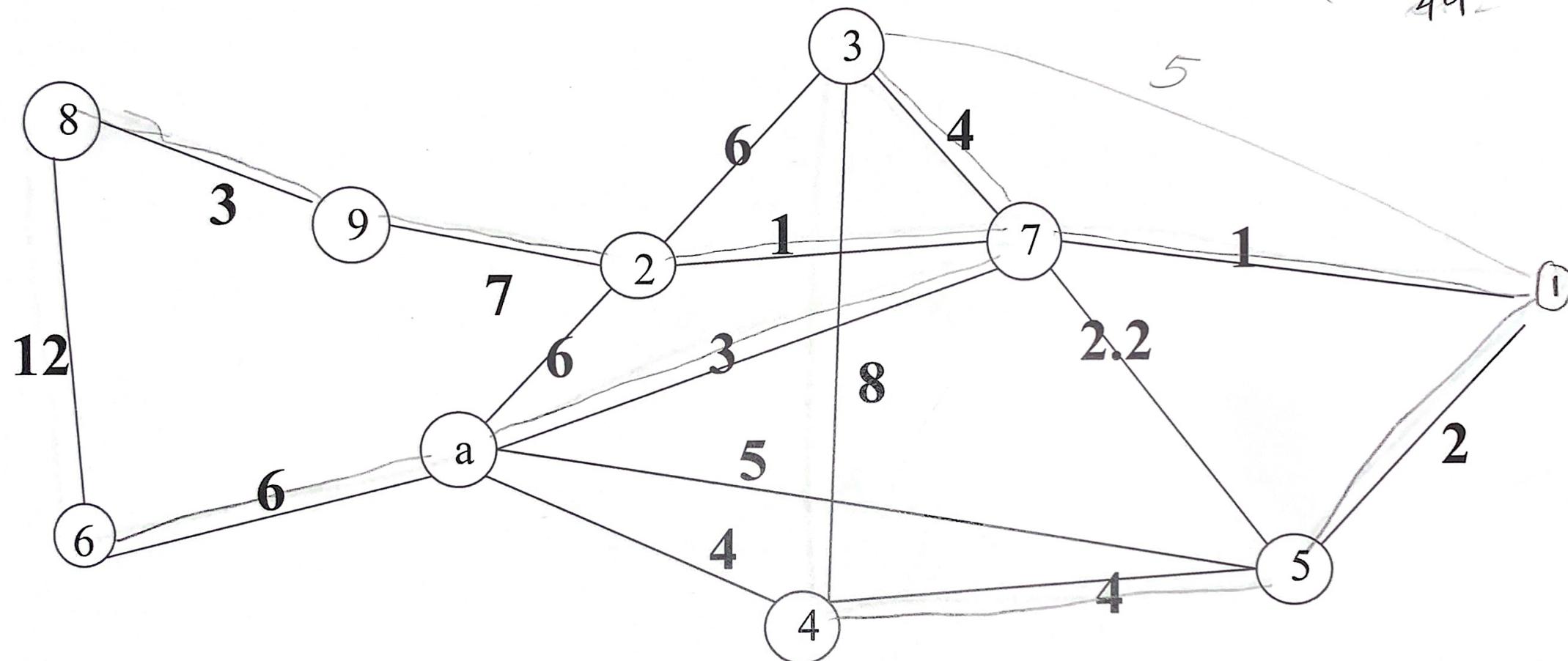
length = 62

MST-heuristic tour (with shortcuts) 15472983a61

length = 61.2

The error of the MST-heuristic is 24.9 %

$$\left(\frac{61.2 - 49}{49} - 1 \right) \times 100 = 24.9$$



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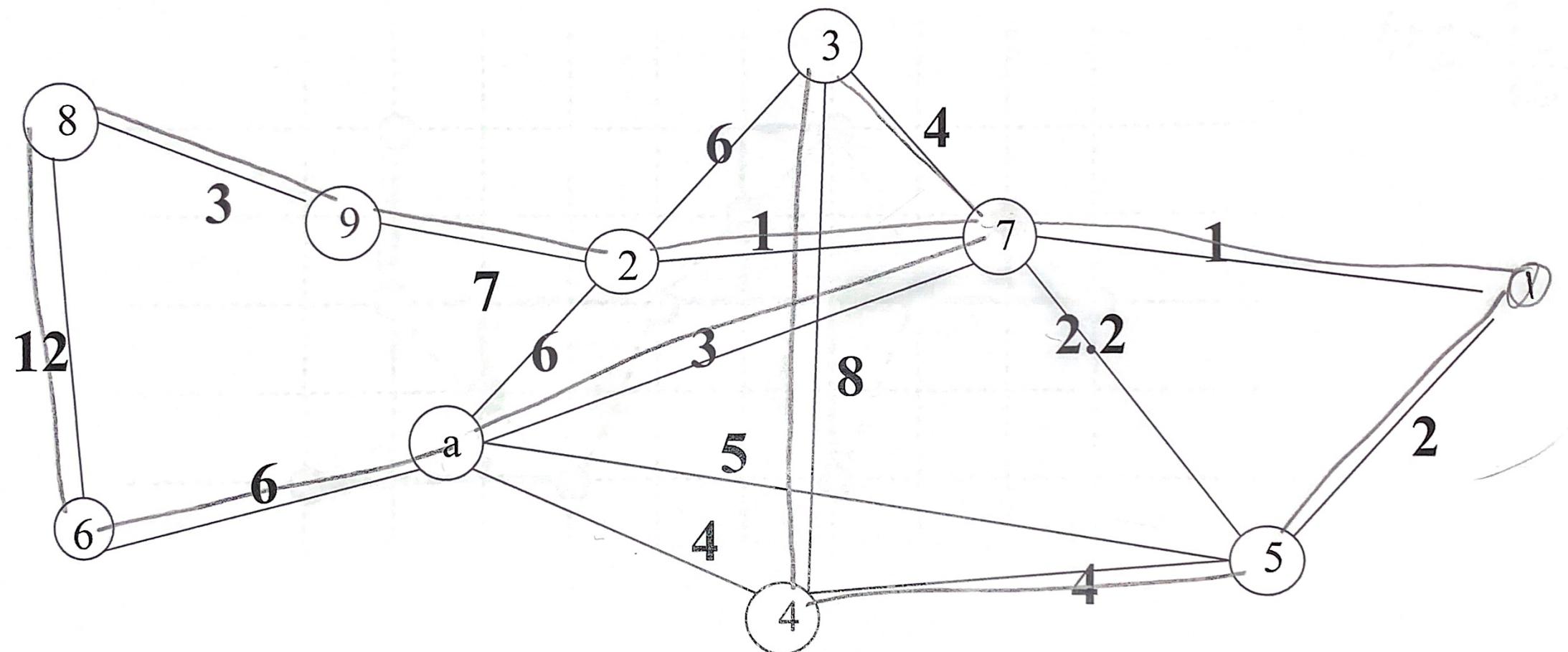
the following graph, find

Christofides heuristic matching (68), (34) *match with smaller weights* length = 20

MST+matching tour 154372986a71 length = $31 + 20 = 51$

Christofides heuristic tour (w/shorts) 154372986a71 length = 51

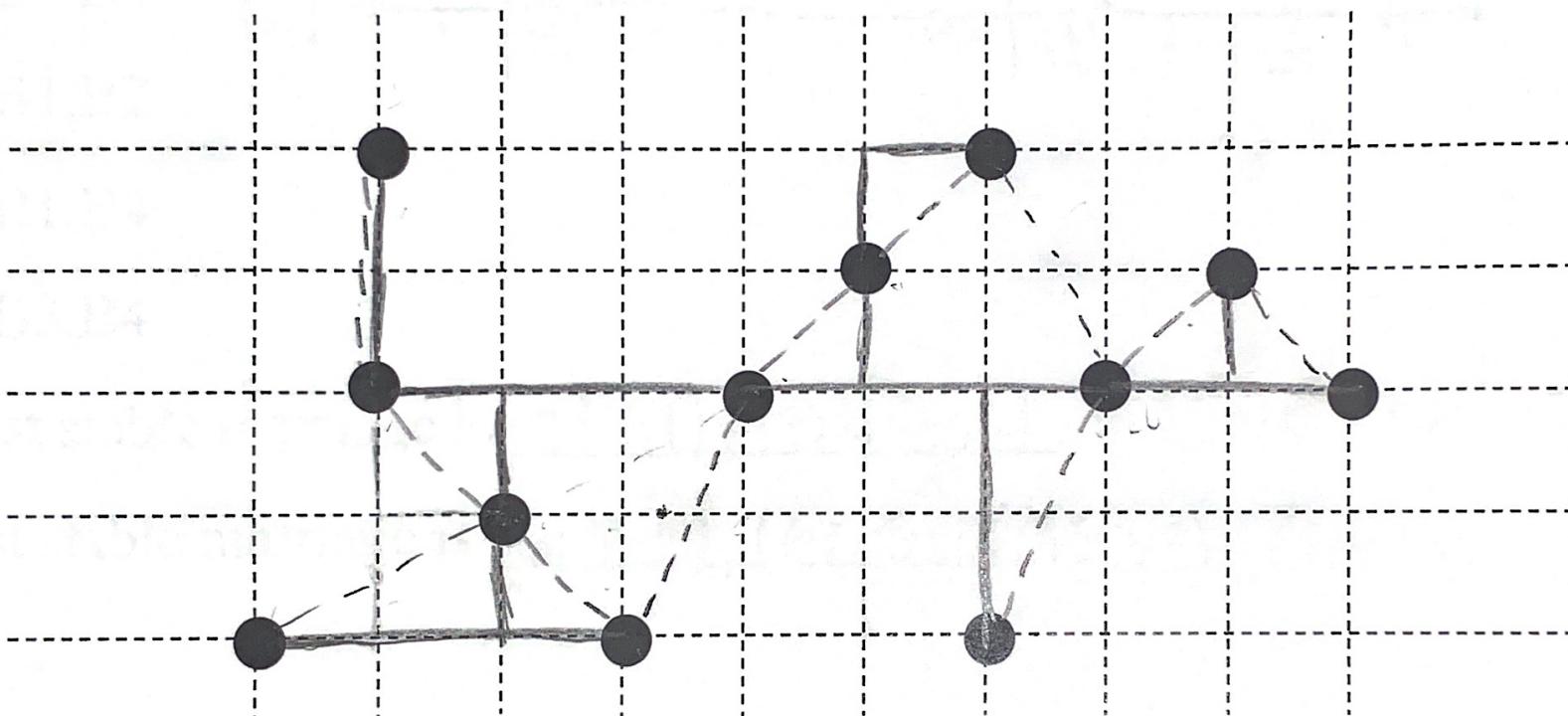
The error of the Christofides heuristic is 6.6% $(51/49 - 1)^{100} =$



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the rectilinear metric for points given below find

- The minimum Steiner tree (bold), its length is $9+12 = 21$
- The minimum spanning tree (dashed), its length is 26
- the approximation ratio of the MST heuristic in this case is $\frac{26}{21}$
- Approximation error in % $(\frac{26}{21} - 1) \times 100 =$



$$\begin{aligned}7 \times 2 &= 14 \\4 \times 3 &= 12 \\&\hline 26\end{aligned}$$

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Given the following stable marriage instance:

B1's preferences: 1st choice=G1, 2nd=G3, next – G4, last – G2

B2: G2,G3,G4,G1

B3: G4,G2,G1,G3

B4: G4,G1,G3,G2

G1: B2,B1,B3,B4

G2: B4,B3,B1,B2

G3: B3,B2,B1,B4

G4: B1,B2,B3,B4

	Boys					Girls				
B1	①	3	4	2	5	G1	②	1	3	4
B2	2	3	4	①	G2	④	3	1	2	
B3	4	2	1	③	G3	③	2	1	4	
B4	4	1	3	②	G4	①	2	3	4	

Boys' best stable marriage is (B1 G1), (B2 ,G2), (B3 ,G4), (B4 ,G3)

Girls' best stable marriage is (G1 B2), (G2 B4), (G3 B3) , (G4 B1)