



• *Mathematics for Computer Science*
MIT 6.042J/18.062J

Stable Matching

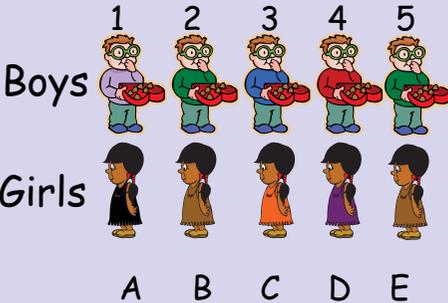


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Stable Marriage

A Marriage Problem



Boys: 1, 2, 3, 4, 5
Girls: A, B, C, D, E



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Stable Marriage

Preferences

<p>Boys</p> <p>1 : CBEAD 2 : ABECD 3 : DCBAE 4 : ACDBE 5 : ABDEC</p>	<p>Girls</p> <p>A : 35214 B : 52143 C : 43512 D : 12345 E : 23415</p>
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Stable Marriage

Preferences

<p>1 : CBEAD 2 : ABECD 3 : DCBAE 4 : ACDBE 5 : ABDEC</p>	<p>Try "greedy" strategy for boys</p>
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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Preferences

Marry **Boy 1** with **Girl C**
(his 1st choice)

1: ~~C~~BEAD

2: ABED

3: D~~C~~BAE

4: A~~C~~DBE

5: AB~~C~~DE





1
C


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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Preferences

2: ABED

3: D BAE

4: A DBE

5: ABDE


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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Preferences

2: ABED

3: DBAE

4: ADBE

5: ABDE


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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Next:

Marry **Boy 2** with **Girl A**
(his remaining 1st choice)

2: ~~A~~BED

3: DBA~~E~~

4: ADBE

5: ABDE



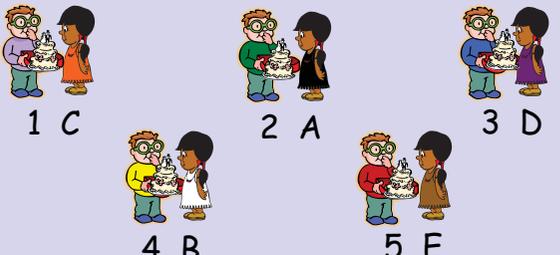


2
A


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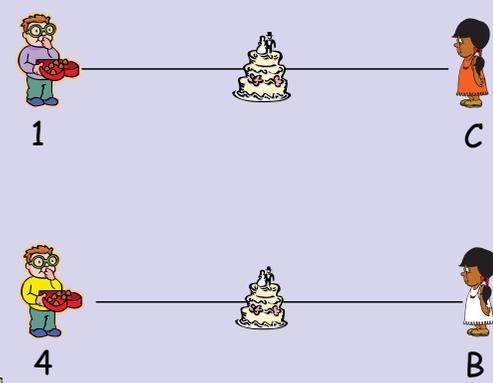

Stable Marriage
 Final "boy greedy" marriages



1 C 2 A 3 D
 4 B 5 E


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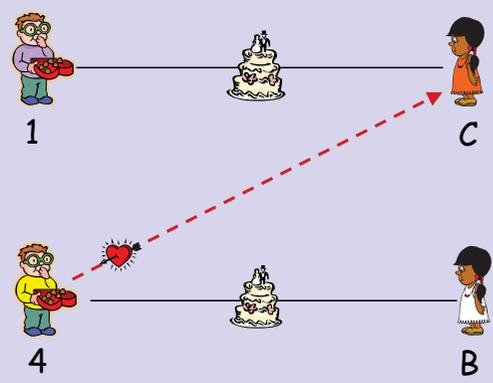

Stable Marriage
Trouble!



1 C
 4 B


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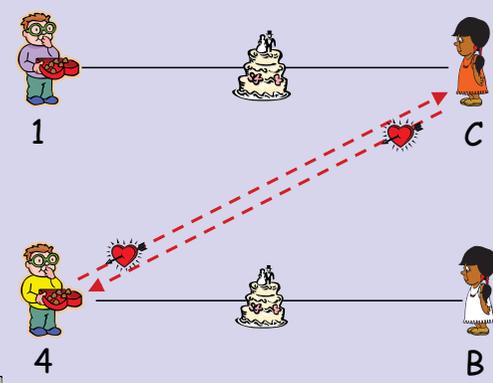

Stable Marriage
 Boy 4 likes Girl C better than his wife.



1 C
 4 B


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Stable Marriage
 and **vice-versa**



1 C
 4 B


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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage
 a **rogue** couple

1 ———— [cake] ———— C
 4 ———— [cake] ———— B

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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Stable Marriage Problem:
 Marry everyone without any rogue couples!

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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Let's try it!

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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage I.

all girls get 1st choice

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6	9	13	7
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3	1	4	14
15	8	11	2

Stable Marriage II



5 A



2 B



4 C



3 D



1 E

"boy optimal"



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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

More than a puzzle:

- College Admissions
(original Gale & Shapley paper, 1962)
- Matching Hospitals & Residents.
- Matching Dance Partners.



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6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Stable Marriage

Photograph of dancing students removed
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