1

Alice: 5, 7, 10, 12, 15, 17, 22

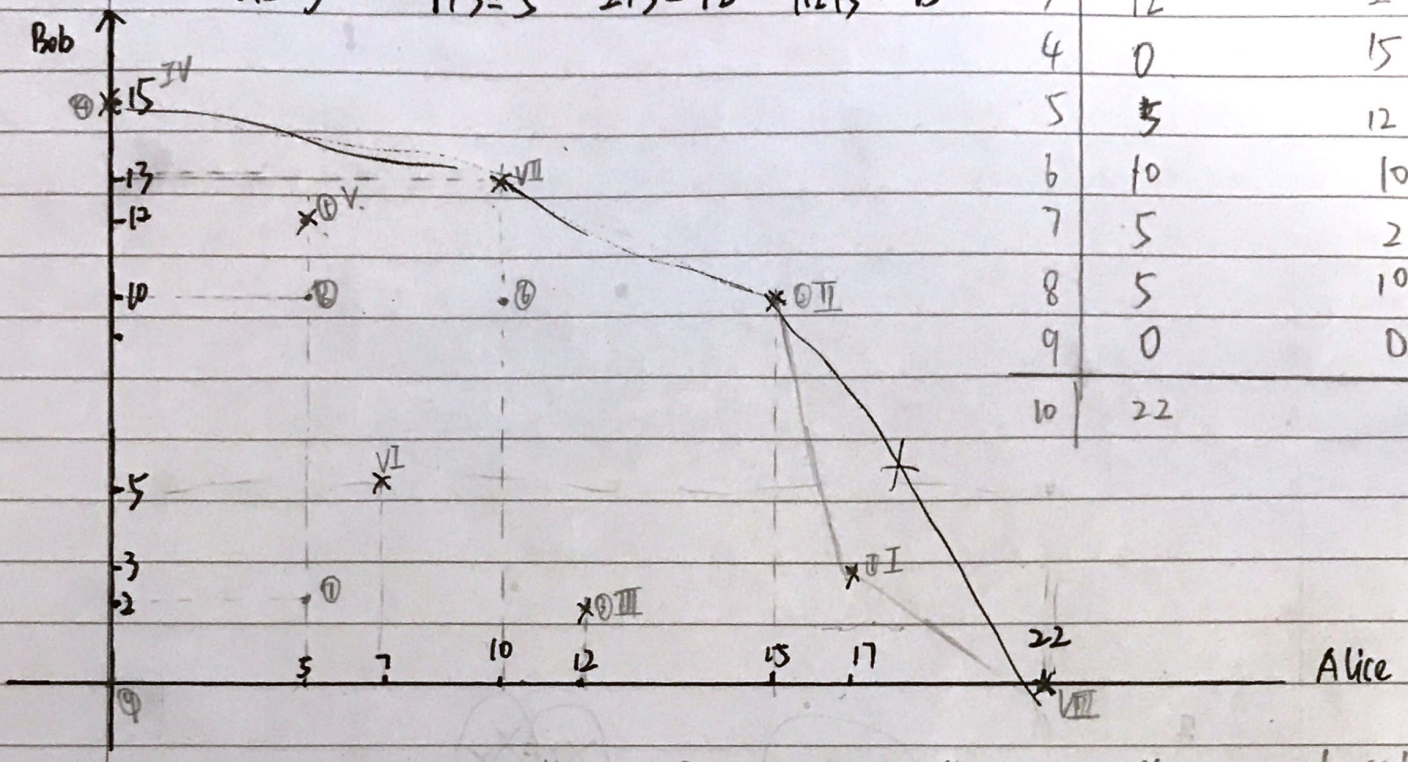
1+2 = 12 2+3 = 17

1+3 = 15 1+2+3 = 22

Bob: 2, 3, 5, 10, 12, 13, 15

1+2=3 1+3=5 2+3=12 1+2+3 = 15

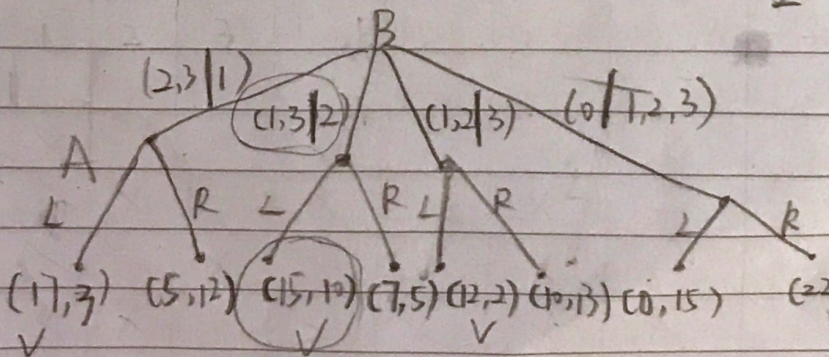
	Alice	Bob
1	17	3
2	15	10
3	12	2
4	0	15
5	5	12
6	10	10
7	5	2
8	5	10
9	0	0
10	22	

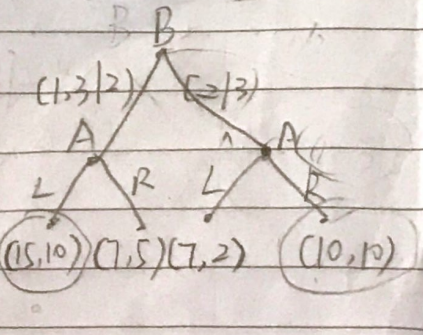


I	2,3(17)	1(13)	V	1(15)	2,3
II	1,3	2	VI	2 17	1,3(5)
III	1,2	3	VII	3(10)	1,2(13)
IV	0	1,2,3	VIII	1,2,3	0

A	B	U_A	U_B	U_A'	U_B'	
23	1	17	3	5	12	X
13	2	15	10	7	5	✓
12	3	12	2		13	X
0	123	0	15	22	0	X
1	23	5	12	17		X
3	2	10	10	7	2	✓
1	3	5	2	10		X
1	2	5	10	7	5	X
0	0	0	0	0	0	✓
2	3	7	2	10	10	X
2	13	7	13	12	10	X

2.





Answer: (1,3|2) / (2|3)

Written Notes (Do not write in right hand)

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4.

		y	1-y
		L	R
x	T	19	9
		13	-5
1-x	B	7	7
		-1	7

$EU_1 = 13xy + (-1)(1-x)y + (-5)x(1-y) + 7(1-x)(1-y)$

$= 13xy - y + xy - 5x + 5xy + 7 - 7y - 7x + 7xy$

$= 26xy - 8y - 12x + 7 = 2x(13y-6) - 8y + 7$

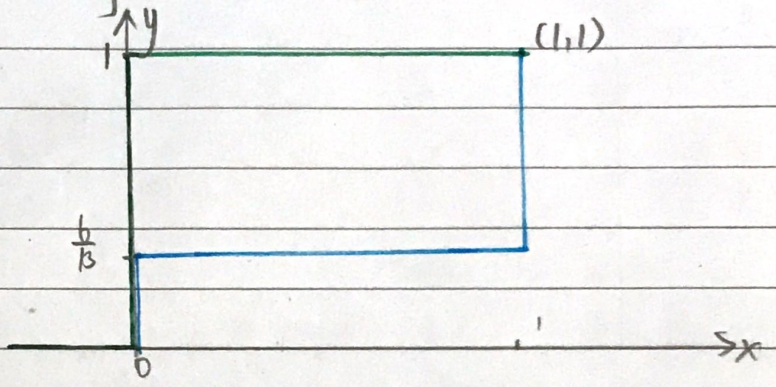
$EU_2 = 19xy + 7(1-x)y + 9x(1-y) + 7(1-x)(1-y)$

$= 19xy + 7y - 7xy + 9x - 9xy + 7 - 7y - 7x + 7xy$

$= 10xy + 2x + 7$

$$br_1(y) = \begin{cases} 0 & y < \frac{6}{13} \\ [0,1] & y = \frac{6}{13} \\ 1 & y > \frac{6}{13} \end{cases}$$

$$br_2(x) = \begin{cases} 0 & x < 0 \\ [0,1] & x = 0 \\ 1 & x > 0 \end{cases}$$



$(0,\frac{1}{4})$ V $(1,1)$ V $(0,\frac{3}{10})$ V $(0,\frac{1}{8})$ V

5. select decline function

1, 2, 3

6.

		winner			winner
C vs D	2/3	D	D vs S	2/3	S
C vs L	3/2	C	D vs W	2/3	W
C vs S	2/3	S	L vs S	2/3	S
C vs W	3/2	C	L vs W	3/2	L
D vs L	3/2	D	S vs W	2/3	W

S:3 C:2 W:2 D:2 L:1

S > C > D > W > L

1 2 3 4 5

7. Borda

C = 5+5+5+2+1 = 18

D = 4+1+3+4+2 = 14

L = 3+4+2+1+3 = 13

S = 2+2+4+3+5 = 16

W = 1+3+1+5+4 = 14

C > S > D > W > L

None

Written Notes

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8. ① $u_1(100)+u_2(100)+u_3(100)=1$ ✓

② A ≻ B:

$u_1(50)+u_2(70)+u_3(60) \geq u_1(80)+u_2(75)+u_3(40)$ ✓

③ × "≥"

④ $u_2(75)-u_2(70)\geq 0$ ✓

⑤ $u_2(100)-u_2(75)\geq 0$ ✓

⑥ ×

⑦ $u_3(55)-u_3(50)\geq 0$ ✓

⑧ × ⑨ × ⑩ ×

9. $\theta_A=10$ $\theta_B=30$ first-price

Envy-free

	Before:		after:		
(1,11)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=19$	$u_A=-1$	$u_B=0$	
(9,10)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=20$	$u_A=0$	$u_B=0$	
(8,9)	A×	B✓	A✓	B×	×
	$u_A=0$	$u_B=21$	$u_A=1$	$u_B=0$	
(25,30)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=0$	$u_A=-20$	$u_B=0$	
(15,16)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=14$	$u_A=-6$	$u_B=0$	
(10,10)	A✓	B×	A×	B✓	×
	$u_A=0$	$u_B=0$	$u_A=0$	$u_B=20$	

	Before		after		
(19,18)	A✓	B×	A×	B✓	×
	$u_A=-9$	$u_B=0$	$u_A=0$	$u_B=12$	
(8,29)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=1$	$u_A=-19$	$u_B=0$	
(31,30)	A✓	B×	A×	B✓	×
	$u_A=-21$	$u_B=0$	$u_A=0$	$u_B=0$	
(29,30)	A×	B✓	A✓	B×	✓
	$u_A=0$	$u_B=0$	$u_A=20$	$u_B=0$	

NASH.= (9,10); (15,16); (29,30)

10. $E[u_i(\theta_i)|b_i]=\theta_i F(b_i)-\sum_{b=0}^{b_i-1}(b\cdot F(b+1)-F(b))$

$E[u_j(8)|4]=0$

$E[u_j(8)|5]=8\times 0.2-[4\times 0.2]=1.6-0.8=0.8$

$E[u_j(8)|6]=8\times 0.25-[4\times 0.2+5\times 0.05]=2-1.05=0.95$

$E[u_j(8)|7]=8\times 0.55-[4\times 0.2+5\times 0.05+6\times 0.3]=4.4-2.85=1.55$

$E[u_j(8)|8]=8\times 0.6-[4\times 0.2+5\times 0.05+6\times 0.3+7\times 0.05)=4.8-3.2=1.6$

$E[u_j(8)|9]=8\times 0.8-[3.2+8\times 0.2]=1.6$

$E[u_j(8)|10]=8\times 0.9-[4.8+9\times 0.1]=1.5$

$E[u_j(8)|11]=8\times 1-[5.7+10\times 0.1]=1.3$

Written Notes

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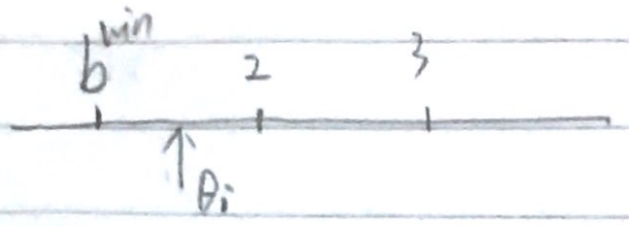
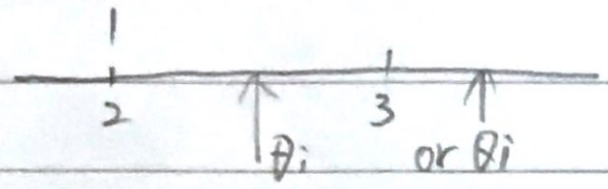
11. ③



when i choose to make a price $> b^{win}$, she will pay 2 and $\theta_i > 2$, So the auction is generally not truthful and an agent has an incentive to overbid

④



when the highest bidder is the same as the second-highest bidder, the auction is truthful.