# SPEC-TOPS THEORY / ALGORITHMS

H·W-4

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1.) money in their wallets = $S_i$ where $i = 1, 2$

Prize is combined contents of two wallets.

ie price goes up until one quits. Say at P (price)

Then the final bidder pays P and gets $S_1 + S_2$

Lets say the $S_1 + S_2 = V$

The equilibrium is when the bidding prices goes up but still at price $2S_i$

So if the opponent also follows the same strategy, then if the bidder who ~~[illegible]~~ wins for P will actually be able to determine the actual value

ie $S_1 + S_2 = V = S_1 + P/2$ as each $P < 2S_i$

so till the range of $2S_i$, i can be a winner and not lose anything, on the other hand if P is $> 2S_i$ then i would lose the money considering the opponent also plays same strategy. This is in unique equilibrium

If $P \geq 2S_i$ the i know that V exceeds P as j's is at least $P/2$ so it is now $> P/2$

now i must quit as j is now greater than $P/2$ which is now a loss for i.

~~Strategy~~ ~~if~~ This symmetric equilibrium can also be explained as let say i stay until P reaches ~~x~~ $S_i$

or say $n \cdot S_i$ while let say j quits at just $\frac{n}{n-1} S_i$

which is lower than $P/_2$ ie $\left( \frac{n}{n-1} S_i < P/_2 \right)$

In this i may win the game then $V = S_i + \frac{n-1}{n} P > P$

but $P < n S_i$

but when j win then $V = S_i + P > P$ but $P < n S_i$

and this time when i wins he will definitely find more many in j wallet so obviously he makes more many
this is an assymmetric equilibium
and usualy j wins less time and finds less many so it is a loss of j whatever he choose.
Thus we can understand this wallet game has many equilibima. We can say that similar common-value game have a very assymmetric equilibia.

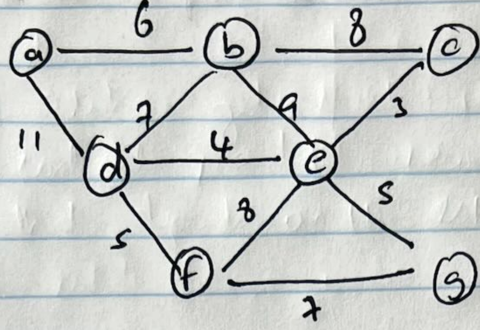
2) by Binary search we get following values

| p | $m_1$ | $m_2$ | $m_3$ | $\varepsilon$ |
|---|---|---|---|---|
| 10 | 8 | 8 | 8 | 24 |
| 20 | 6 | 7 | 7 | 20 |
| 30 | 5 | 6 | 5 | 16 |
| 40 | 3 | 3 | 4 | 10 |
| 50 | 2 | 3 | 2 | 7 |
| 60 | 0 | 2 | 1 | 3 |
| 70 | 0 | 1 | 0 | 1 |

On analyzing the allocation algorithm for down word sloping validation

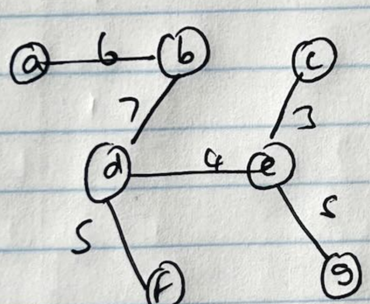
$\varepsilon = 24, 20, 16, 10, 7, 3, 1$
for $p = 10, 20, 30, 40, 50, 60, 70$

3.) Graph:




We need to get minimum spanning tree

which is the shortest distance




by calculating VCG payments we get

ab = 35 − 24 = 11

bd = 31 − 23 = 8

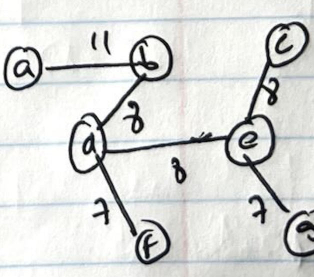
ce = 35 − 27 = 8

de = 34 − 26 = 8

df = 32 − 25 = 7

eg = 32 − 35 = 7

So the minimum spanning tree with VCG is



4). Digital goods to be sold at fixed.

→ Order the bids in descending order for obtaining an optimal fixed price.

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| b | 10 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| Revenue | 10 | 20 | 30 | 36 | 45 | 48 | 56 | 64 | 63 | 70 | 66 | 72 | 65 | 70 | 60 | 64 | 68 | 72 | 76 | 80 |

20
4
80

Deterministic optimal Auction (DOA) is truthful, with more revenue (with appropriate "distribution" assumption can be made).

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