CAT 2025

MBA FASTRACK BATCH

Lecture - 03 | Logical Reasoning

Games & Tournaments-1

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TOPICS *to be covered*

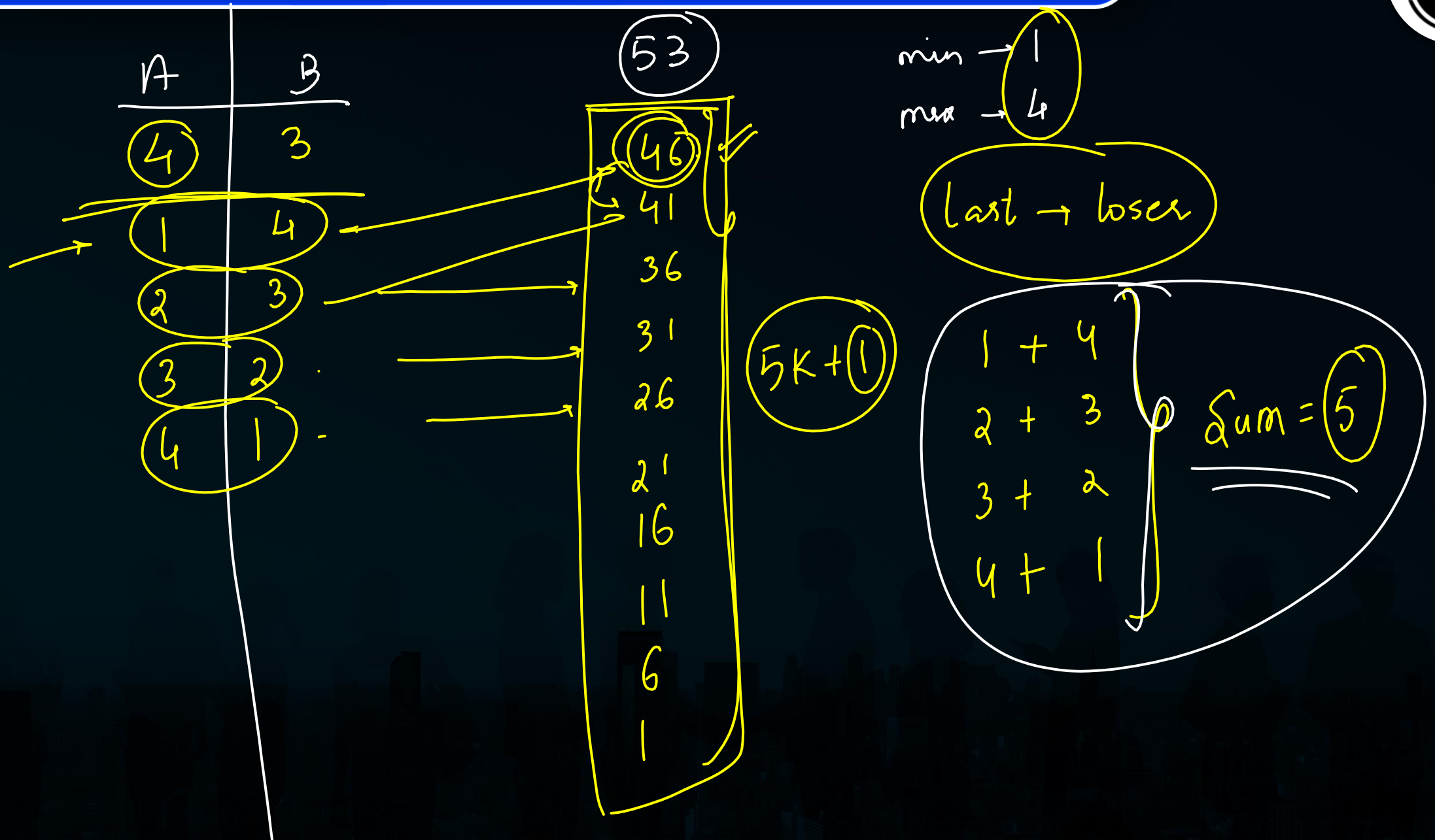
1. We are playing some Games.
2. Basics of Knockout Tournaments
3. Questions on Knockout Tournaments

Games : Coins or Matchsticks

Directions :

- A and B were playing a game, which involved picking coin/s from the table.
- Each player, in their turn, was to pick a minimum of 1 coins or a maximum of 4 coins, except when there is only one coin left, in that case, she has to pick up that coin.
- The game continues, till all the coins are removed from the table.
- Both of them are intelligent and want to win the game.
- Now an interesting thing comes up, "**One who picks up the last coin loses the game**".

Analysis :


A
B
4
3
1
4
2
3
3
2
4
1
53
46
41
36
31
26
21
16
11
6
1
5K+1
min → 1
max → 4
last → loser
1 + 4
2 + 3
3 + 2
4 + 1
Sum = 5

Analysis :

A	B
4	3

53 - 4 = 49

46

41

26

21

16

11

6

+5 x 2/3/4/5

1

min 1 max 4

1 + 4 = 5

2 + 3 = 5

3 + 2 = 5

4 + 1 = 5

1

A	B
2	3
2	1
4	

53

51 =

46

41

1

1

1

1 – 4

Sum = 5 =

1

1, 6, 11, 16, 21, ... 46, 51, .

5K + 1

5k + 1

min → 1

max → 7

→ $8K+1$ → $9C+1 = 97$

→ $192 + 1 = 193$

Last → loser

Initial:

	Pick in 1st turn to win
100	3
200	7
249	

$248 + 1 = 249 = 8K+1$

241

0/8 X

min → 1
max → 7

] ⟶ 8K = 96

Last → winner.

Initial.	I^st turn.
100	→ 4

last → loser min → 1 max → 4

#Q. If the game starts with 50 coins and it is A's turn to pick up first, then how many coins should he pick to ensure his win? 4

$5K + 1 = 46$

#Q. If the game starts with 78 coins and it is B's turn to pick up first, then how many coins should he pick to ensure his win? 2

$5K + 1 = 76$

#Q. If the game starts with 96 coins and it is A's turn to pick up first, then how many coins should he pick to ensure his win? Cannot Win

$5K + 1 = 91, 96$

#Q. If the number of coins to be picked by A is 3 in his first turn, in order to win the game irrespective of the number of coins that B wants to pick in her turn, then what cannot be the total number of coins on the table?

A. 44 ✓ **B. 79** ✓ **C. 97** ✗ **D. 99** ✓

$3 + (5K+1) = 5K+4$

#Q. If the game starts with 50 coins and it is A’s turn to pick up first, then how many coins should he pick to ensure his win?

#Q. If the game starts with 78 coins and it is B’s turn to pick up first, then how many coins should he pick to ensure his win?

#Q. If the game starts with 96 coins and it is A’s turn to pick up first, then how many coins should he pick to ensure his win?

#Q. If the number of coins to be picked by A is 3 in his first turn, in order to win the game irrespective of the number of coins that B wants to pick in her turn, then what cannot be the total number of coins on the table?

A. 44 **B. 79** **C. 97** **D. 99**

Knockout

Tournaments

16 Teams. → Ranked (1 to 16)

R-1 | T = 16 | M = 8

1 - 16
2 - 15
3 - 14
4 - 13
5 - 12
6 - 11
7 - 10
8 - 9

R-2 | T = 8 | M = 4

1 - 8
2 - 7
3 - 6
4 - 5

R-3 | T = 4 | M = 2

1 - 4
2 - 3

R-4 | T = 2 | M = 1

1 - 2

Total
Rounds = 4
Matches = 15

64 Teams → power of 2

Total Matches = Teams − 1

Rounds = 6

$64 = 2^6$

$\text{Teams} = 2^n$

64 = 32 = 16 = 8 = 4 = 2 = 1

6 times

n → Rounds

	1	2	3	4	5	6
Teams	64	32	16	8	4	2

Matches: 32 + 16 + 8 + 4 + 2 + 1

= 63

64 Teams → 1 Team

Eliminated (63) teams.

1 match → 1 team eliminates

63 match → 63

① Upset:

Rank - 1 : Rank 64

Winner.

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② Bye

Basics of Knockout Tournaments

Knockout Tournaments are the tournaments in which in each round, the winner of a match between two players advances in the next round while the loser is eliminated. This process is repeated till the finals.

Basics of Knockout Tournaments

Let us say, in a tournament, there are ‘n’ players, where n is a power of 2 (16, 32, 64,…), and they are ranked or seeded from 1 to n.

{Seed (rank) 1 is the highest and seed (rank) n is the lowest seed}

Round 1: There will be n/2 matches.

In the first round,

Match 1: Seed 1 will play against Seed n.

Match 2: Seed 2 will play against Seed n - 1.

Match 3: Seed 3 will play against Seed n - 2.

Match 4: Seed 4 will play against Seed n - 3.

……

……

Basics of Knockout Tournaments

Round 2:

In the second round:

The winner of Match 1 will play against the winner of Match (n/2).

The winner of Match 2 will play against the winner of Match (n/2) – 1.

The winner of Match 3 will play against the winner of Match (n/2) – 2.
……. and so on..!

Followed by Round 3, then Round 4……finally Round k, if $n = 2^k$

Some Important Terms

Upset

In such kind of tournaments, an '**UPSET**' comes into the picture, which essentially means that a lower seeded plays beats a higher seeded player.

Rank

Bye

It is when a player advances to the next round without playing a match.

Let’s Use some examples for Clarity

Directions :

- 128 players participated in a tennis tournament.
- The players are seeded from 1 to 128 with seed 1 being the top seed and seed 128 being the last seeded player. The tournament takes place in a knockout format with different rounds.
- In each round, the winner of a match between two players advances in the next round while the loser is eliminated. This process is repeated till the finals.
- In the first round, the player seeded 1 plays the player seeded 128, the player seeded 2 plays the player seeded 127, and so on.
- An upset is said to happen if the lower seeded player beats a higher seeded player. The matches are scheduled such that, in case of no upsets in each round, the highest player plays the lowest-seeded player left in the tournament.
- The second-highest seeded player plays the second-lowest seeded player left and so on.

Analysis :

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Terms 128	64	32	16	8	4	2
Match 64	32	16	8	4	2	1
Sum = 129	Sum = 65	Sum = 33	Sum = 17			
1 – 128	1 – 64	1 – 32				
2 – 127	2 – 63	2 – 31				
3 – 126	3 – 62	3 – 30				
4 – 125	⋮	⋮				
⋮	⋮	⋮				
31 – 98						

#Q. How many rounds are there in the tournament?

#Q. How many matches will be played in the tournament?

#Q. Which player faced the player seeded 11 in the pre quarter finals (round 4) if the tournament had no upsets?

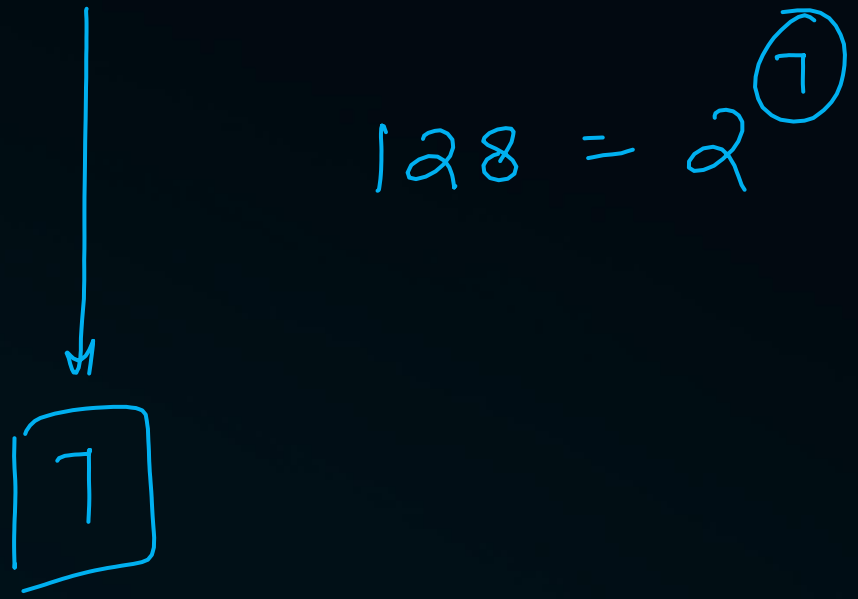
#Q. If there were no upsets in the tournament, which of the following seeds never played against the player who is seed 5?

A. 124 **B. 60** **C. 27** **D. 12**

#Q. If the player who was seeded 116 reached the semi-finals, then at least how many matches resulted in upsets?

#Q. If the tournament had only two upsets, then maximum how many matches can Seed 23 win?

#Q. How many rounds are there in the tournament?



#Q. How many matches will be played in the tournament?

$$128 - 1 = \boxed{127}$$

#Q. Which player faced the player seeded 11 in the pre quarter finals (round 4) if the tournament had no upsets?

Round	Teams	Sum
1	128	
2	64	
3	32	
4	16	17
5		
6		
7		

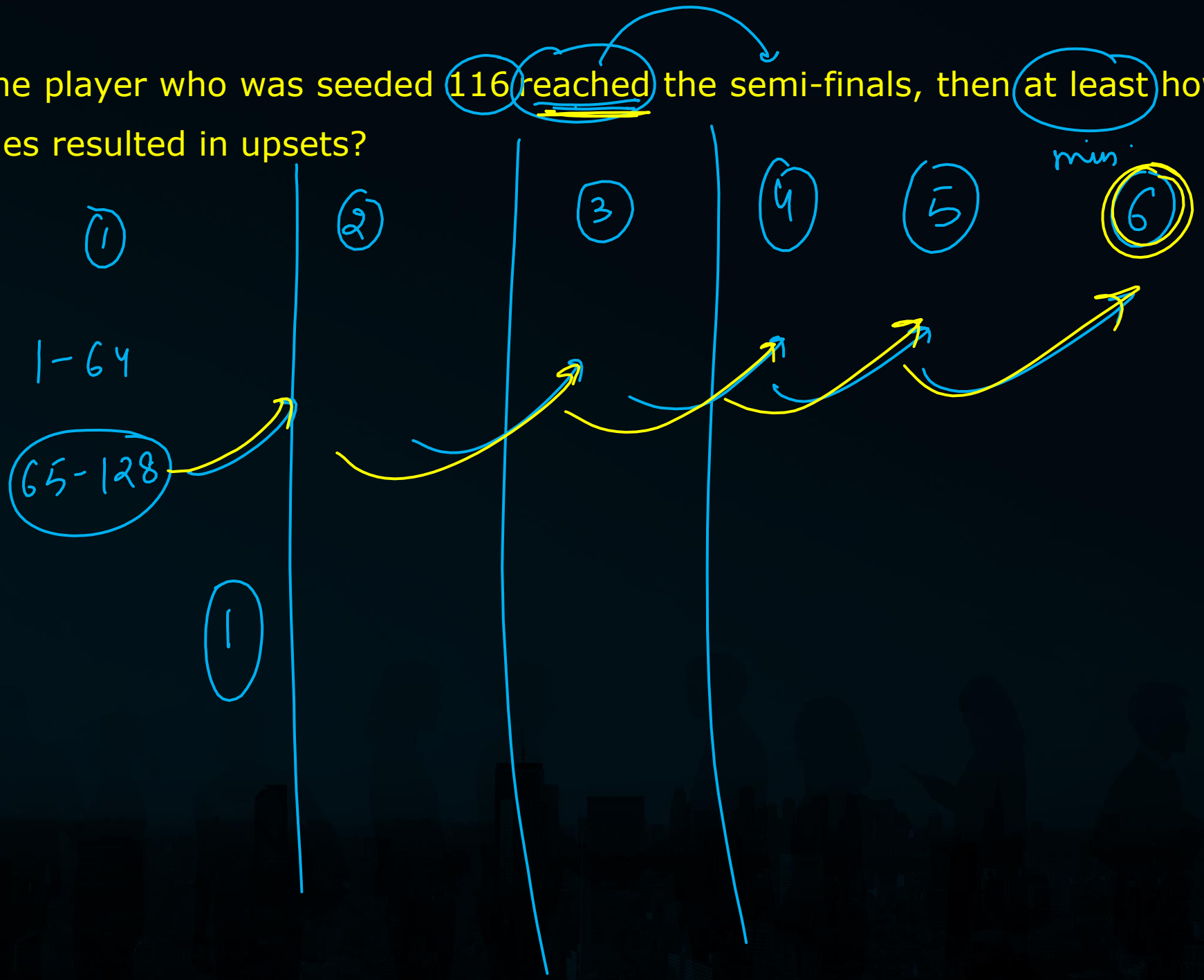
$17 - 11 = \boxed{6}$ → Ans.

#Q. If there were no upsets in the tournament, which of the following seeds never played against the player who is seed 5?

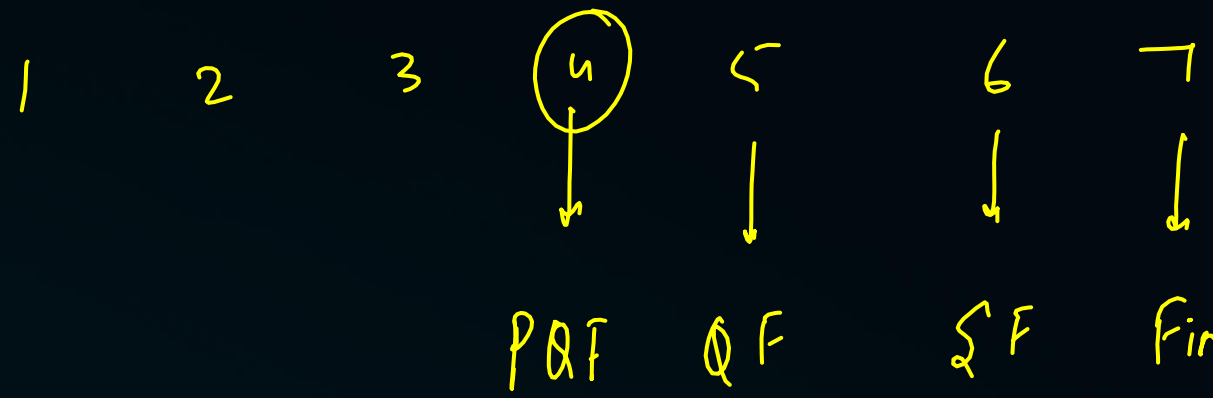
A. 124 ✗ **B. 60** ✗ **C. 27** ✓✓ **D. 12**

Round	No. of Teams.	Sum	Opponent of 5
1	128	129	129 − 5 = 124 ✓
2	64	65	65 − 5 = 60 ✓
3	32	33	33 − 5 = 28 ✓
4	16	17	17 − 5 = 12 ✓
5	8	9	9 − 5 = 4 ✓
6	4	✗	✗
T	2		

#Q. If the player who was seeded 116 reached the semi-finals, then at least how many matches resulted in upsets?



#Q. If the tournament had only two upsets, then maximum how many matches can Seed 23 win?


1
2
3
4
5
6
7
PQF
QF
SF
Final


THANK
You
52%
64%
85%
26,465.54
28,161.92
26,465.54
198.45
37,492.43
201.55
1,097.95
0.00
26,717.43
7,534.44
12,512.54
28,875.56