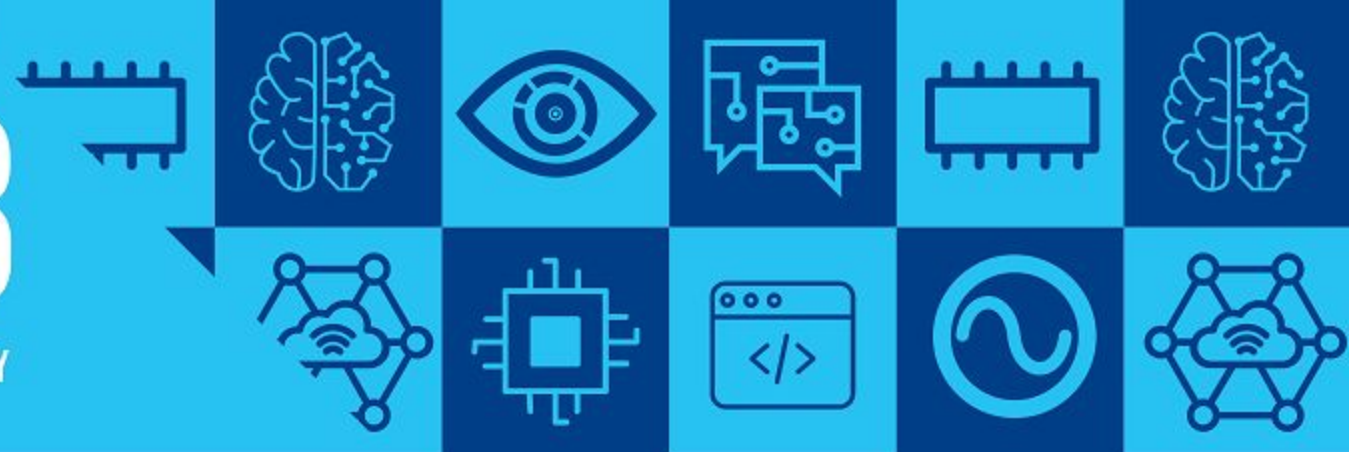




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ROUND-2

Funckit

After solving the PS1 of Funckit event, let's move to the next problem statement.

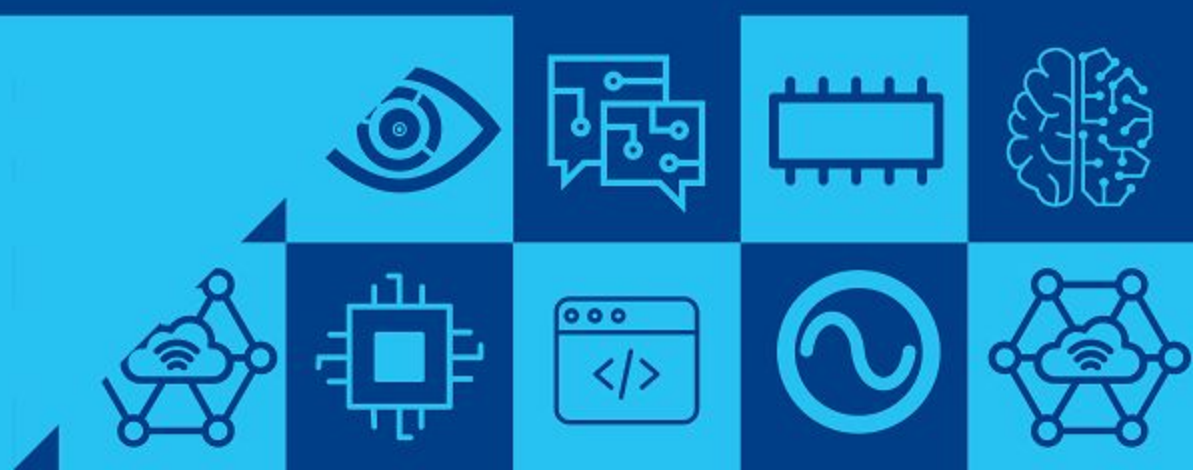
Vini likes to create new rules for any game and this time she named her game as TwiceWin. She asked Nai to play with her, and he agreed. Now time to explain the rules.

There will be total three rounds to decide the winner, the player who wins two or more of them will be the winner. In each round, a number “n” will be given, and they have to subtract the highest power of 2 less than the number. They will play alternatively; the player unable to do it will lose the game.

As the game is created by Vini she will always start the first round, second round will be started by Nai and third round by Vini. Now your task is to find out who will win in the end. It will be more clear from the examples below:



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$$n < 2^8$$

1. Three rounds with: $n=200$, $n=243$, $n=100$

So first Vini will start: $200 \rightarrow 72(200-128) \rightarrow 8(72-64) \rightarrow 0(8-8)$ Vini wins this round

Now Nai will start:

$243 \rightarrow 115(243-128) \rightarrow 51(115-64) \rightarrow 19(51-32) \rightarrow 3(19-16) \rightarrow 1(3-2) \rightarrow 0$
Vini wins

Now Vini will start next round:

$100 \rightarrow 36(100-64) \rightarrow 4(36-32) \rightarrow 0$ Vini wins

So Vini won the game as she wins 3 rounds.

2. $n=30$, $n=90$, $n=65$

$30 \rightarrow 14 \rightarrow 6 \rightarrow 2 \rightarrow 0$ Vini started, Nai won

$90 \rightarrow 26 \rightarrow 10 \rightarrow 2 \rightarrow 0$ Nai started, Vini won

$65 \rightarrow 1 \rightarrow 0$ Vini started, Nai won

So Nai won the game as he won 2 rounds.

3. $n=185$, $n=250$, $n=80$

$185 \rightarrow 57 \rightarrow 25 \rightarrow 9 \rightarrow 8 \rightarrow 0$, Vini started, vini won

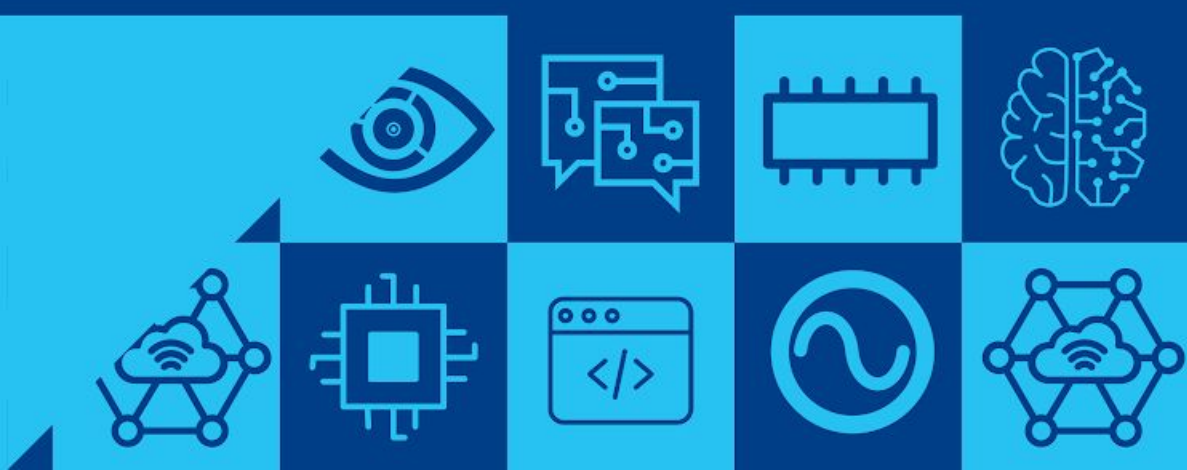
$250 \rightarrow 122 \rightarrow 58 \rightarrow 26 \rightarrow 10 \rightarrow 2 \rightarrow 0$, Nai started, Vini won

$80 \rightarrow 16 \rightarrow 0$, Vini started, Nai won

So Vini won as she won 2 rounds .



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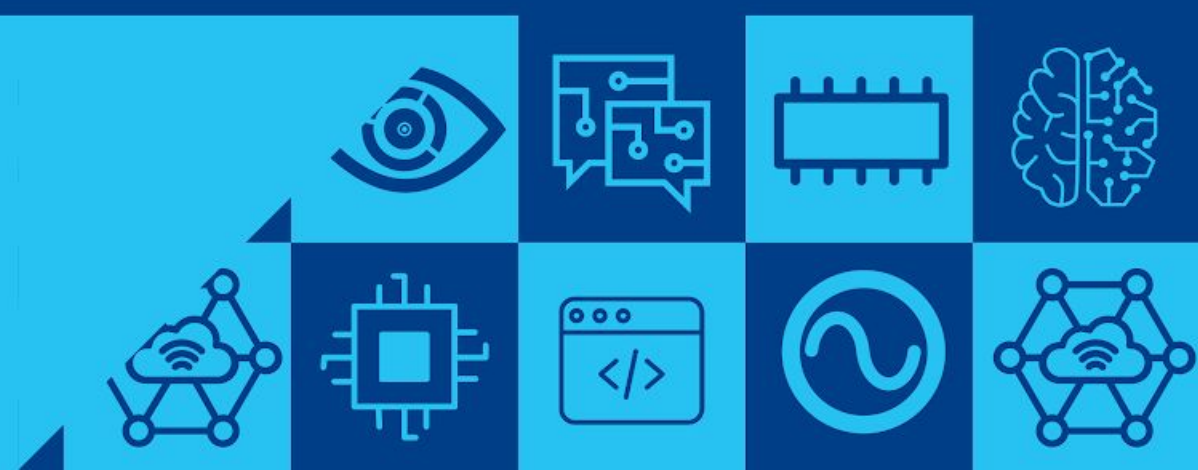
You have to make a circuit for a round and then check manually by giving input for each round one by one, who will win the round and eventually who will win the game.

Hint: For example, take the test case 1, give the input 200 find out the winner (keep in mind who started the game), then again reset the circuit and give input 243, find out the winner, again reset the circuit and give input 100, find out the winner. Keep track of who won the each round. The player winning the maximum no. of rounds will be the winner of game.

There will be extra points for creativity.



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Components to be used:

Gates:

- Not gates
- Quadruple 2-Input Positive-AND Gates [74HC08]
- Quad 2-input positive-OR gates [74HC32]
- Quadruple 2-Input Exclusive-OR Gates [74HC86]
- Triple 3-Input OR Gates [74HC4075]

Etc. (any of the 74 series gates can be used)

Flip-flops:

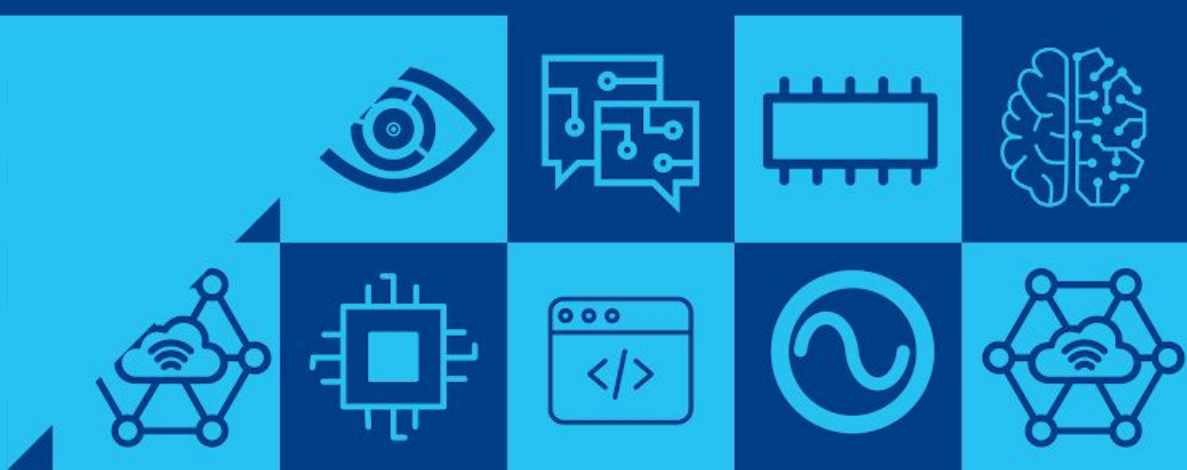
- Dual Positive-Edge-Triggered D-Type Flip-Flops [74LS74]
- Dual J-K Positive edge triggered flip flops with clear and preset [74LS109]
- Quadruple D type positive triggered flip flops with clear [74LS175]
- Octal D type positive triggered flip flops with clear [74LS273]

Counters:

- Synchronous 4-Bit Binary Counters [74LS161]
- 8 bit binary counter with tristate output registers [74LS590]
- 4-Bit Synchronous up/down Binary Counters [74LS169]
- 4 bit binary Full adder with fast carry [74LS283]
- 4 bit multiplier with open collector outputs [74284, 74285]
- 4 bit bidirectional universal shift registers [74194]
- Quadruple 1 or 2 Data selectors/ Multiplexer [74LS157]



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Comparator :

- 8 bit identity comparator [75LS688]
- 4 bit magnitude comparator [74HC85]

Buffer :

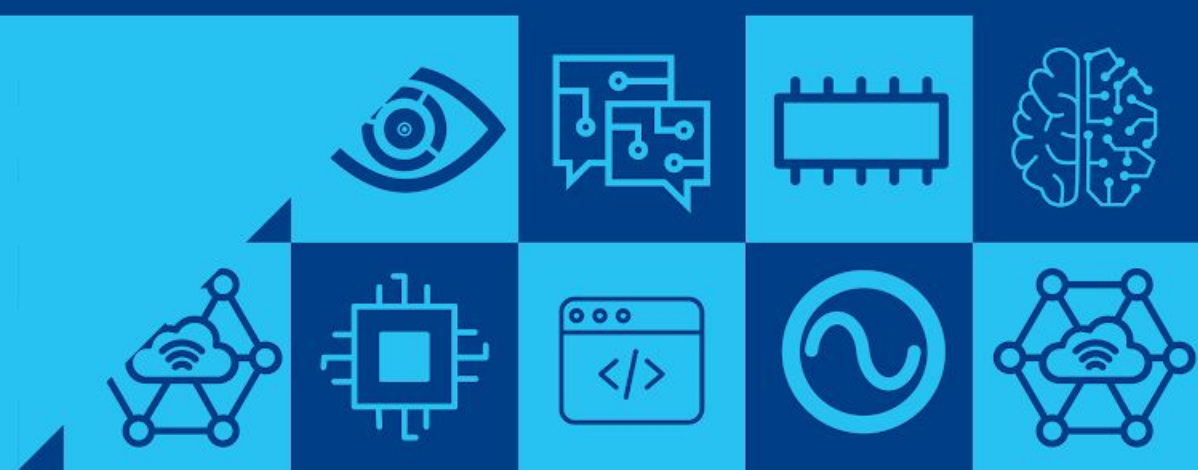
- Quadruple buffer gate with tristate output [74HC125]
- Octal Buffer with tristate outputs [74HC241]

Cost of various Components:

- Gates with 1 or 2 inputs - 1
- Gates with 3 or 4 inputs - 2
- Gates with more than 4 inputs - 3
- 4/8 bit counter – 6
- Adder (4 bit) -4
- Adder (8 bit) -8
- Multiplier(4 bit)- 6
- Multiplier(8 bit)- 10
- 4-bit comparator - 11
- Buffer – 3
- Single Flip-flop-1
- Register(4-bit) – 4
- Register(8-bit) – 8
- MUX - 8



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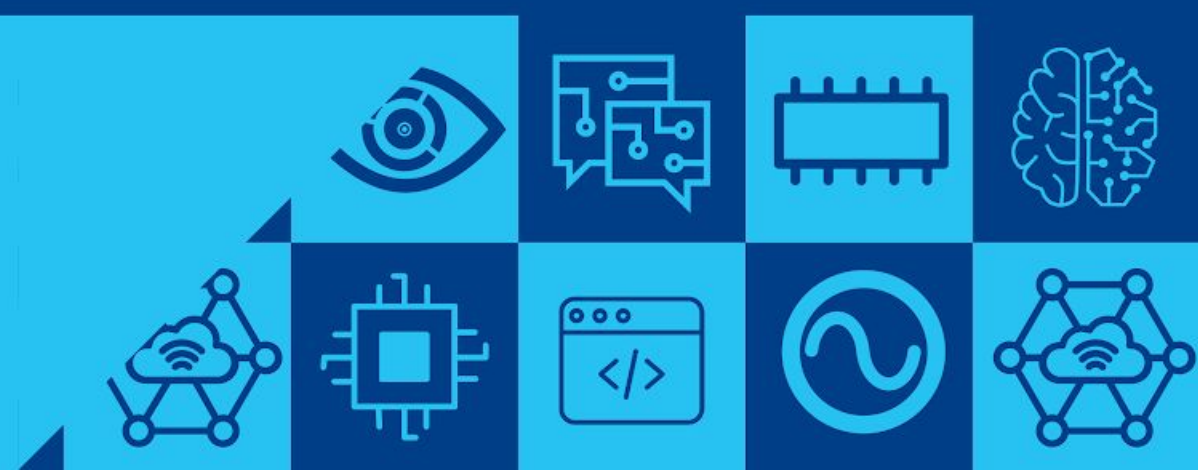
FuncKit

Submission guidelines: ([Submission link](#))

- Write the components used in circuits and their number.
- Submit a proteus design file, a screen recording showing the working of the circuits and a pdf explaining the circuits and the components used .
- There will be extra points for solving the problem in a creative way.
- Circuits with a lesser no. of components will be preferred.
- Try to keep your circuit as simple as possible.
- Submission for PS2 is acceptable even though you haven't submitted PS1.
- Deadline: 7 April 2023, 8:00 am



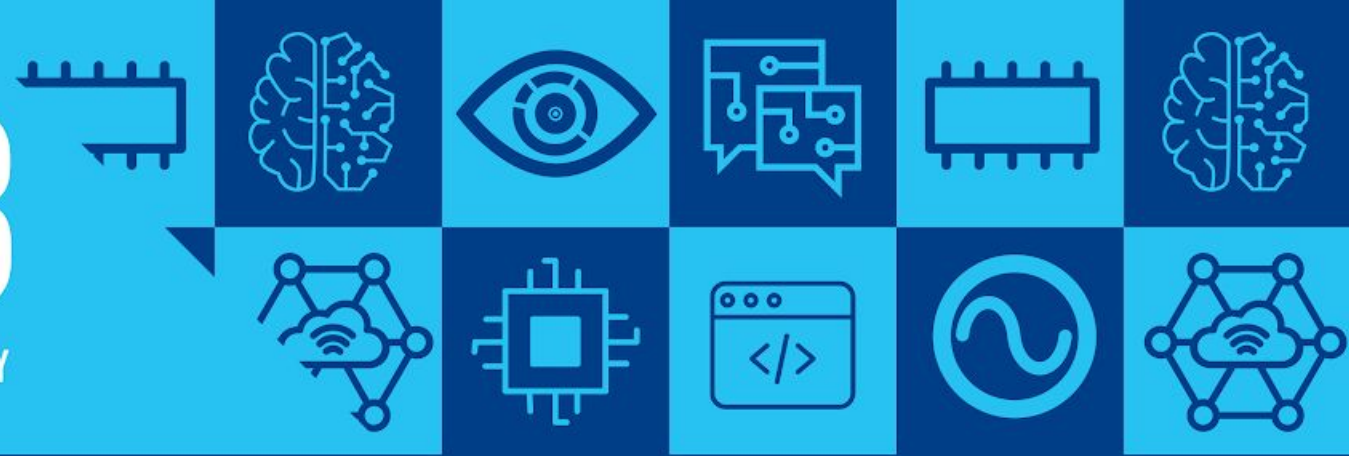
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