Three-pile 21

In this game there are 3 tokens in one pile, 4 tokens in a second pile and 5 tokens in a third pile.

Play the game with a partner. Can you find a strategy for one player to the other to win?

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Which of these statements do you think is true?

_____ The first player will always win.

_____ The second player will always win.

_____ It is just a matter of luck and anyone can win.

Can you justify your choice?

_____

_____

Fill out the table to systematically work out who would win a game using fewer tokens.

Pile 1	**Pile 2**	**Pile 3**	**Who wins?**	**Why?**
1	1	1		
1	1	2		
1	1	3		
1	1	*u*		
1	2	*u*		
1	3	*u*		
1	*t*	*u*		
2	3	4		

Who do you think would win:

A game with 3, 6 and 9 tokens? _____

A game with 3, 5 and 8 tokens? _____

A game with 4, 5 and 7 tokens? _____

Can you explain why?

_____

_____

Is the following conjecture true?

> **Conjecture:** Suppose there are three piles with *s*, *t* and *u* tokens.
>
> Kuparr will win if one of *s*, *t* and *u* is divisible by 3 and the other two have the same remainder when divided by 3. Robyn will win otherwise.

If it is, prove it. If it isn't, write the correct conjecture and prove it.

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