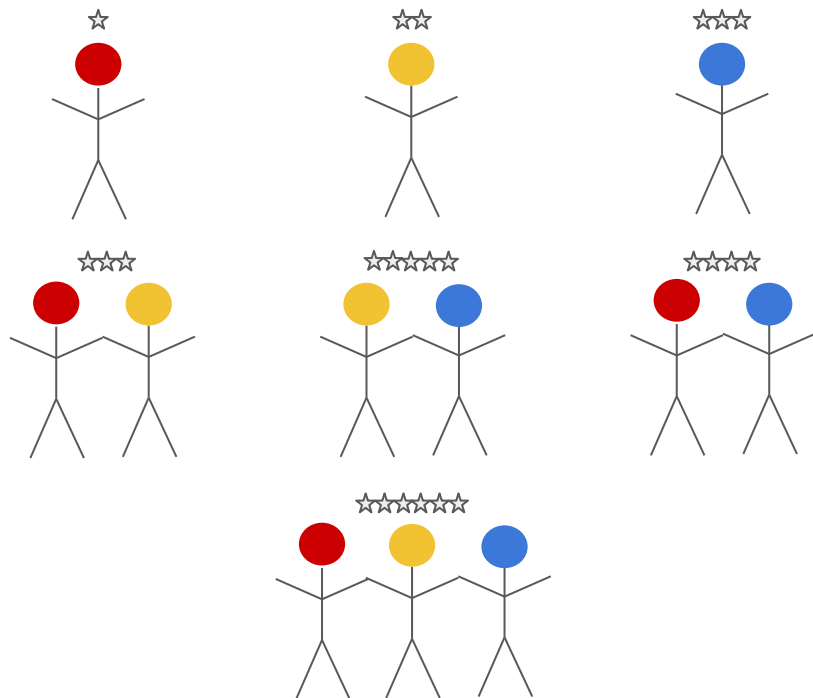
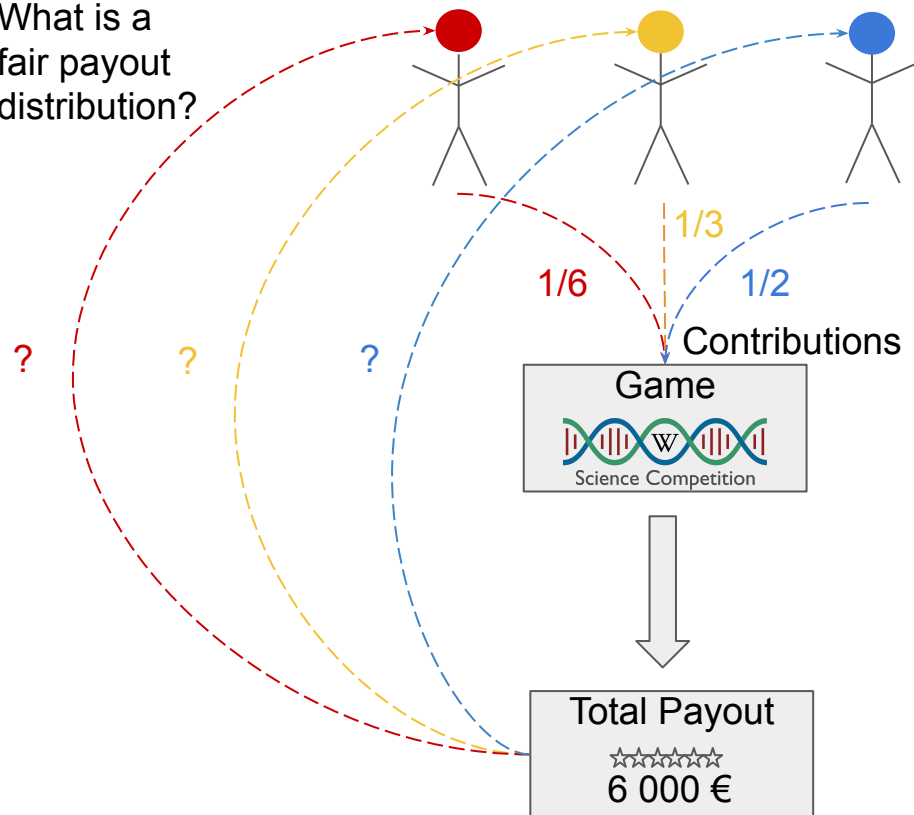


Players do not interact
(payouts ☆ add up in each coalition)

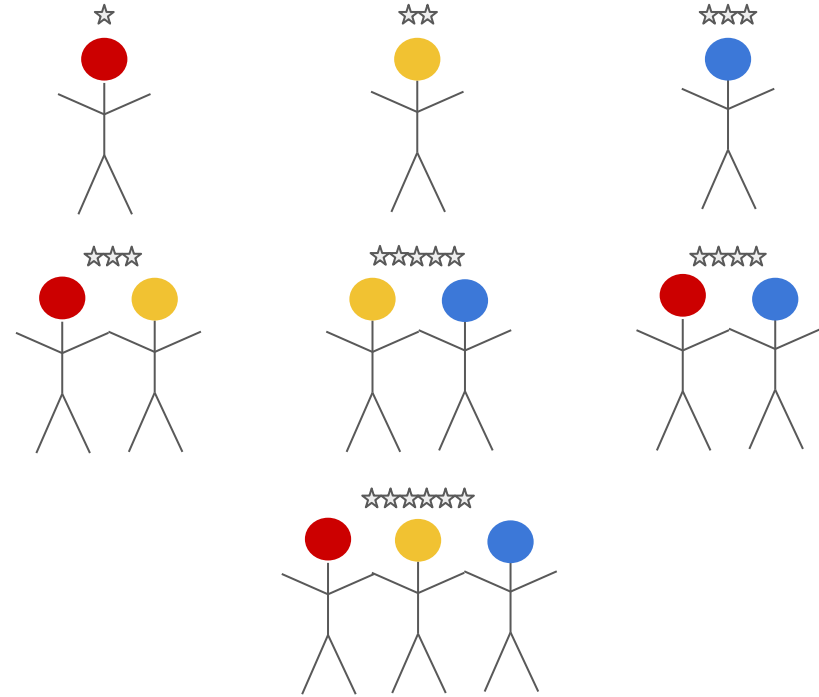


What is a
fair payout
distribution?

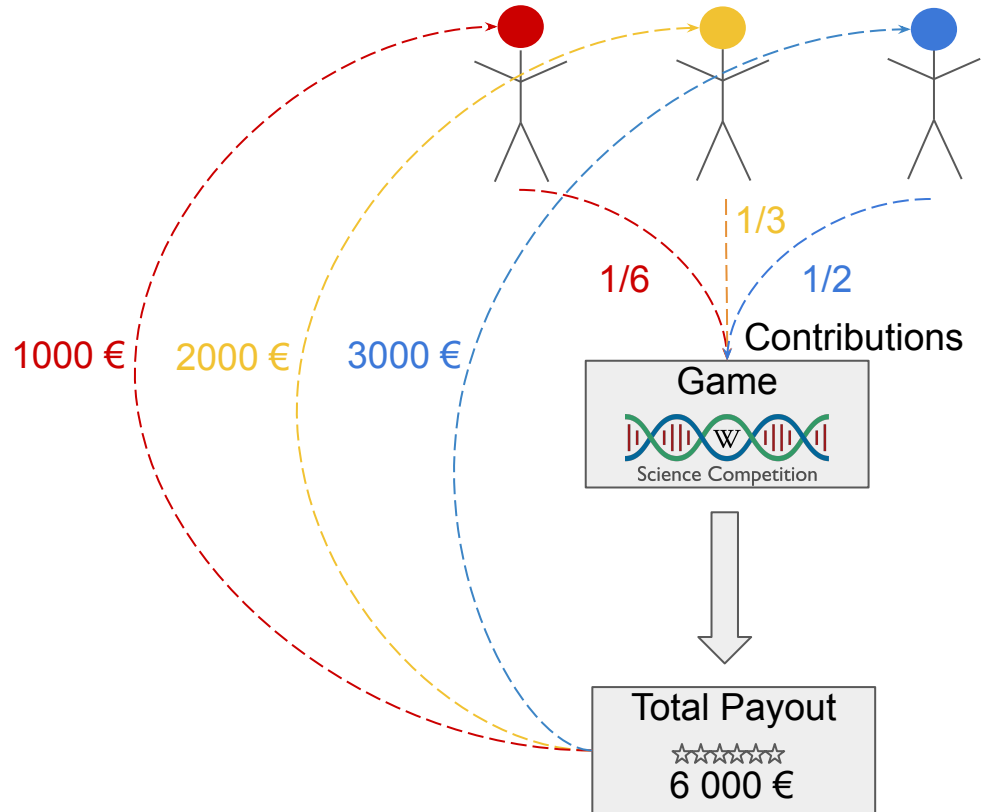
Players do not interact



Players do not interact
(payouts ☆ add up in each coalition)

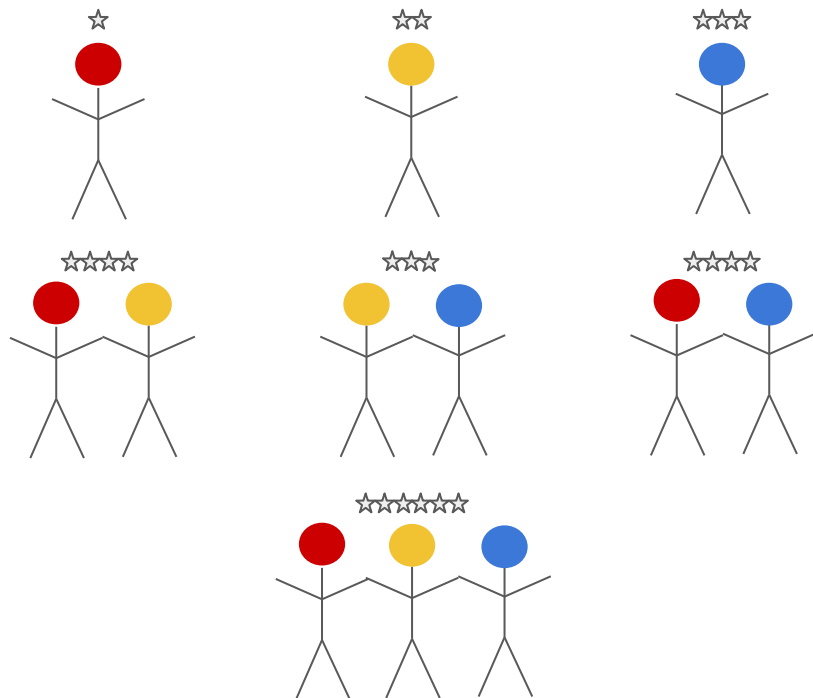


Players do not interact



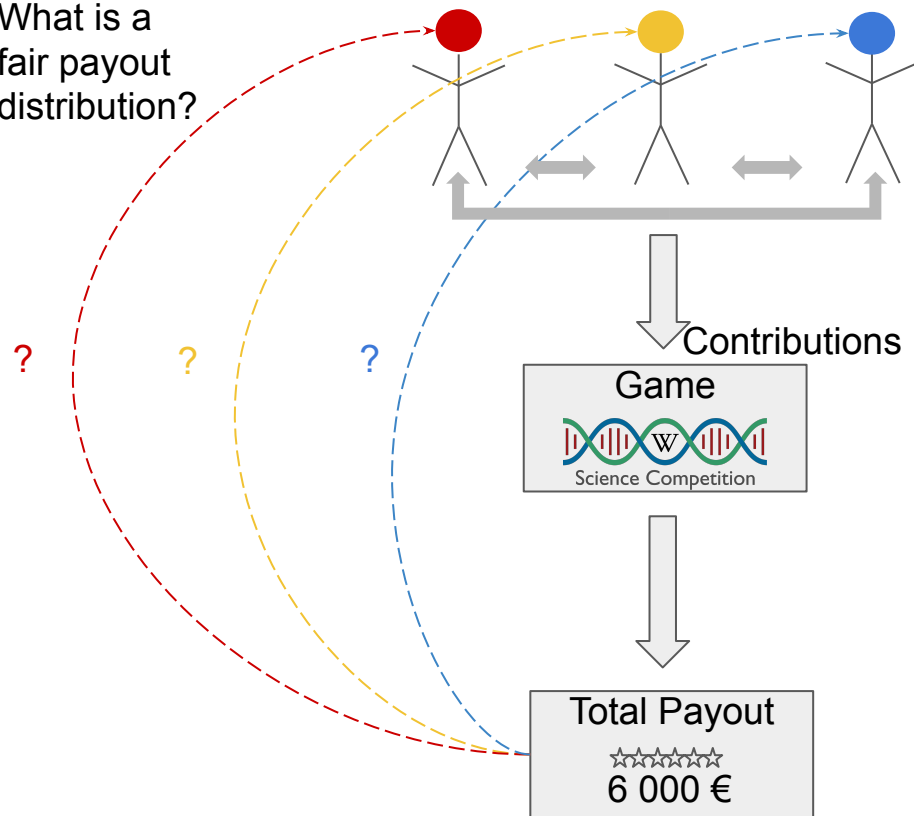
Players interact

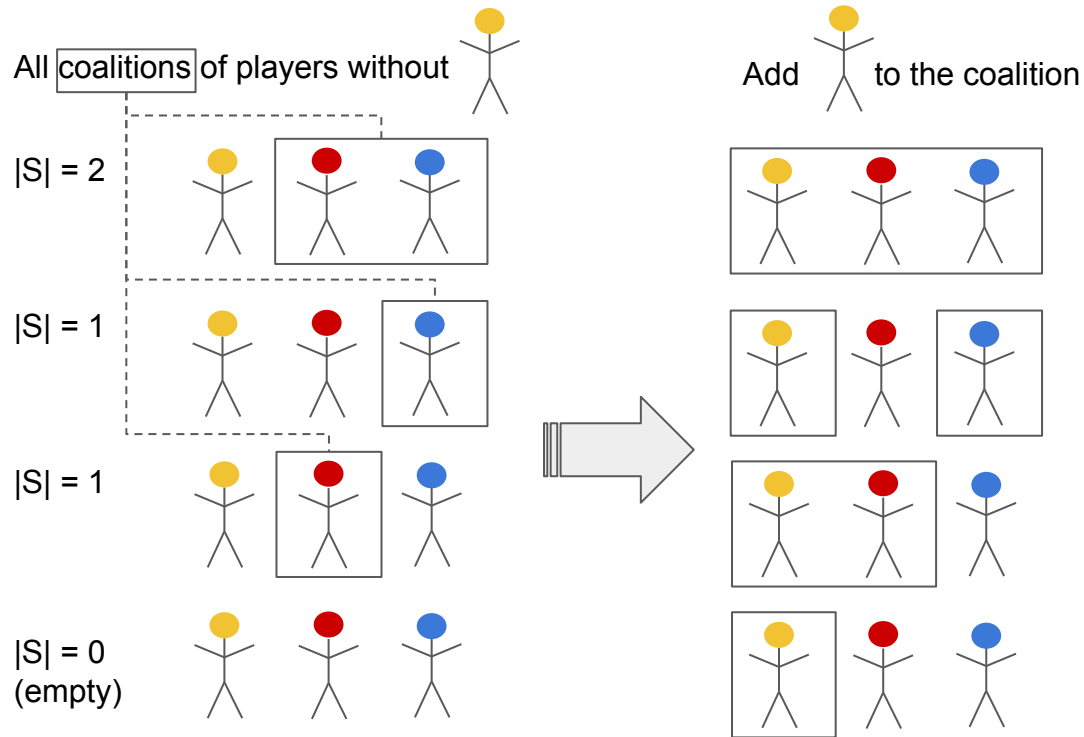
(payouts ☆ do not add up)




What is a fair payout distribution?

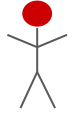
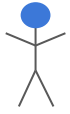
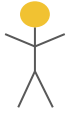
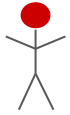
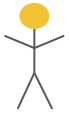
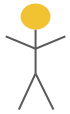
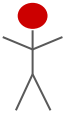
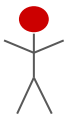
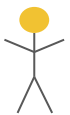
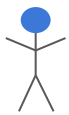
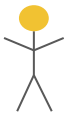
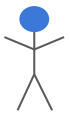
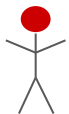
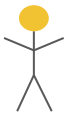
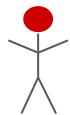
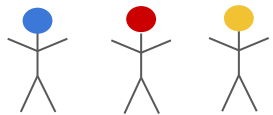
Players interact



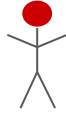
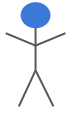
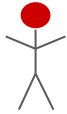
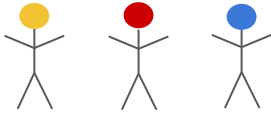
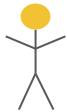
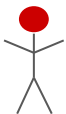
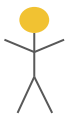
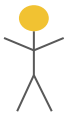
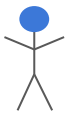
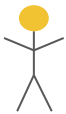
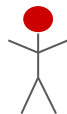
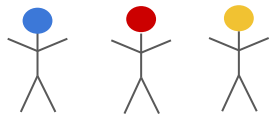


- Compute total payout of each coalition
- Compute difference in total payout for each coalition with and without player 
- Sum up weighted differences in total payout

$|P|! = 6$ orders



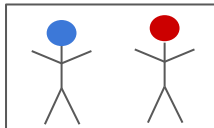
$|P|! = 6$ orders



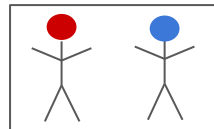
via orders

(players before “yellow” player)

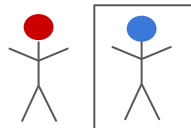
$|S| = 2$
weight = $1/6$



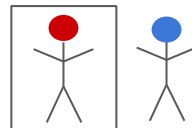
$|S| = 2$
weight = $1/6$



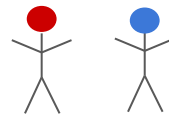
$|S| = 1$
weight = $1/6$



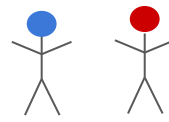
$|S| = 1$
weight = $1/6$



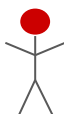
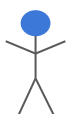
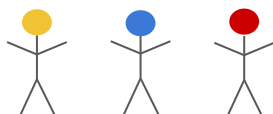
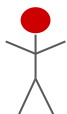
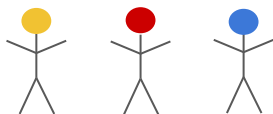
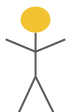
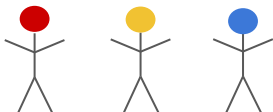
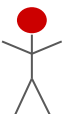
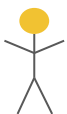
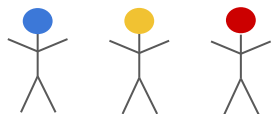
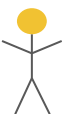
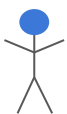
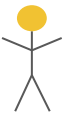
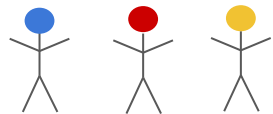
$|S| = 0$
weight = $1/6$



$|S| = 0$
weight = $1/6$



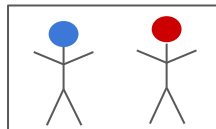
$|P|! = 6$ orders



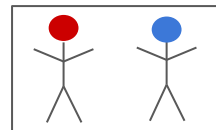
via orders

(players before “yellow” player)

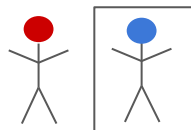
$|S| = 2$
weight = $1/6$



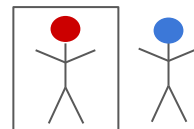
$|S| = 2$
weight = $1/6$



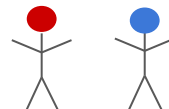
$|S| = 1$
weight = $1/6$



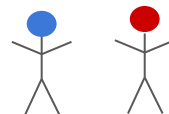
$|S| = 1$
weight = $1/6$



$|S| = 0$
weight = $1/6$

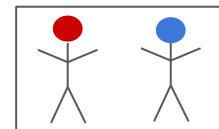


$|S| = 0$
weight = $1/6$

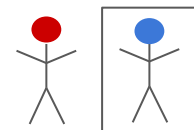


via sets

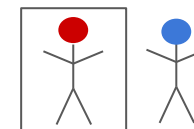
$|S| = 2$
weight = $2/6$



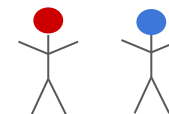
$|S| = 1$
weight = $1/6$

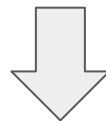
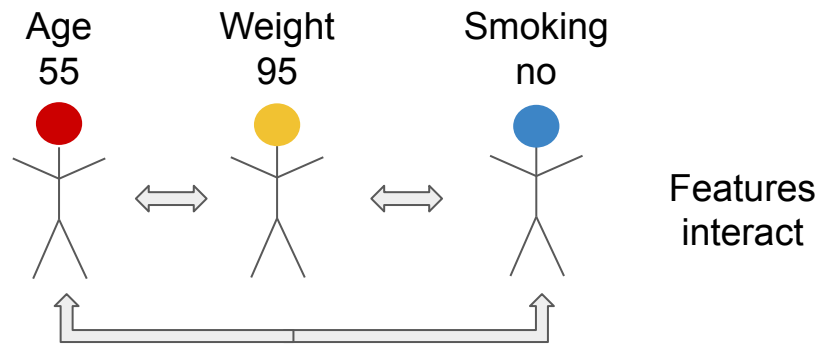


$|S| = 1$
weight = $1/6$



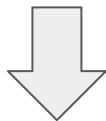
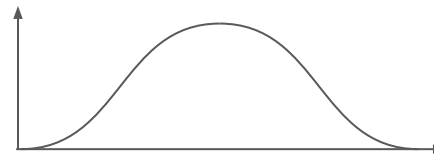
$|S| = 0$
weight = $2/6$





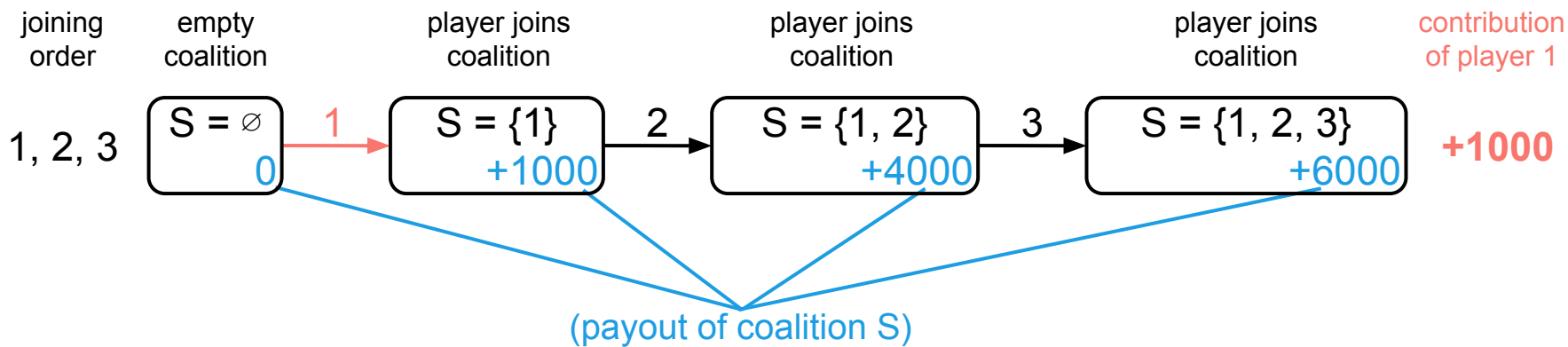
Contributions

Predictive
model



Predicted target, e.g.,
disease risk

10%



joining order	empty coalition	player joins coalition	player joins coalition	player joins coalition	contribution of player 1
1, 2, 3	$S = \emptyset$ 0	$S = \{1\}$ +1000	$S = \{1, 2\}$ +4000	$S = \{1, 2, 3\}$ +6000	+1000
1, 3, 2	$S = \emptyset$ 0	$S = \{1\}$ +1000	$S = \{1, 3\}$ +4000	$S = \{1, 2, 3\}$ +6000	+1000
2, 1, 3	$S = \emptyset$ 0	$S = \{2\}$ +2000	$S = \{1, 2\}$ +4000	$S = \{1, 2, 3\}$ +6000	+2000
2, 3, 1	$S = \emptyset$ 0	$S = \{2\}$ +2000	$S = \{2, 3\}$ +3000	$S = \{1, 2, 3\}$ +6000	+3000
3, 1, 2	$S = \emptyset$ 0	$S = \{3\}$ +3000	$S = \{1, 3\}$ +4000	$S = \{1, 2, 3\}$ +6000	+1000
3, 2, 1	$S = \emptyset$ 0	$S = \{3\}$ +3000	$S = \{2, 3\}$ +3000	$S = \{1, 2, 3\}$ +6000	+3000

Shapley value of player 1  : +1833.33

joining order	empty coalition	player joins coalition	player joins coalition	player joins coalition	contribution of player 2
1, 2, 3	$S = \emptyset$ 0	1 → $S = \{1\}$ +1000	2 → $S = \{1, 2\}$ +4000	3 → $S = \{1, 2, 3\}$ +6000	+3000
1, 3, 2	$S = \emptyset$ 0	1 → $S = \{1\}$ +1000	3 → $S = \{1, 3\}$ +4000	2 → $S = \{1, 2, 3\}$ +6000	+2000
2, 1, 3	$S = \emptyset$ 0	2 → $S = \{2\}$ +2000	1 → $S = \{1, 2\}$ +4000	3 → $S = \{1, 2, 3\}$ +6000	+2000
2, 3, 1	$S = \emptyset$ 0	2 → $S = \{2\}$ +2000	3 → $S = \{2, 3\}$ +3000	1 → $S = \{1, 2, 3\}$ +6000	+2000
3, 1, 2	$S = \emptyset$ 0	3 → $S = \{3\}$ +3000	1 → $S = \{1, 3\}$ +4000	2 → $S = \{1, 2, 3\}$ +6000	+2000
3, 2, 1	$S = \emptyset$ 0	3 → $S = \{3\}$ +3000	2 → $S = \{2, 3\}$ +3000	1 → $S = \{1, 2, 3\}$ +6000	+0

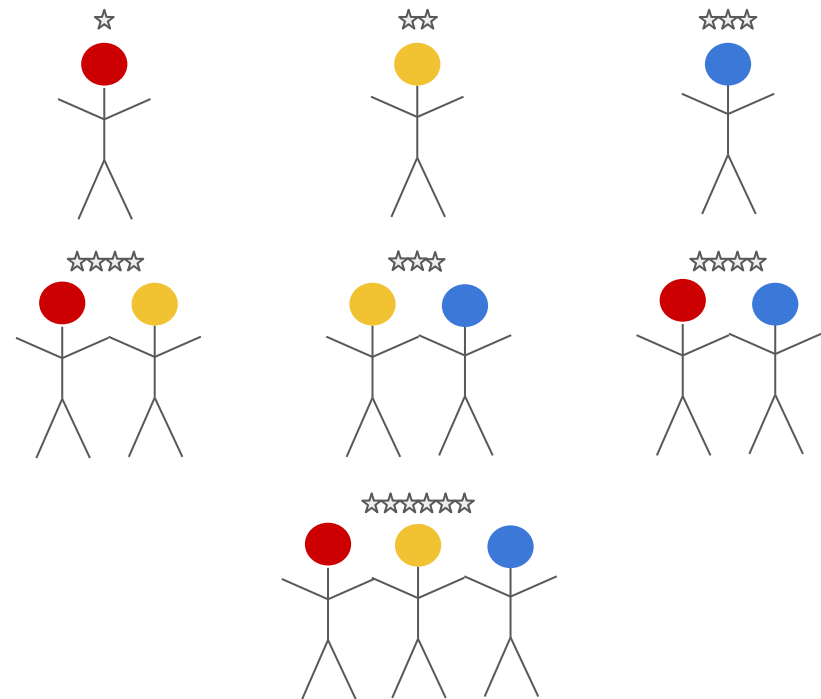
Shapley value of player 2  : +1833.33

joining order	empty coalition	player joins coalition	player joins coalition	player joins coalition	contribution of player 3
1, 2, 3	$S = \emptyset$ 0	1 → $S = \{1\}$ +1000	2 → $S = \{1, 2\}$ +4000	3 → $S = \{1, 2, 3\}$ +6000	+2000
1, 3, 2	$S = \emptyset$ 0	1 → $S = \{1\}$ +1000	3 → $S = \{1, 3\}$ +4000	2 → $S = \{1, 2, 3\}$ +6000	+3000
2, 1, 3	$S = \emptyset$ 0	2 → $S = \{2\}$ +2000	1 → $S = \{1, 2\}$ +4000	3 → $S = \{1, 2, 3\}$ +6000	+2000
2, 3, 1	$S = \emptyset$ 0	2 → $S = \{2\}$ +2000	3 → $S = \{2, 3\}$ +3000	1 → $S = \{1, 2, 3\}$ +6000	+1000
3, 1, 2	$S = \emptyset$ 0	3 → $S = \{3\}$ +3000	1 → $S = \{1, 3\}$ +4000	2 → $S = \{1, 2, 3\}$ +6000	+3000
3, 2, 1	$S = \emptyset$ 0	3 → $S = \{3\}$ +3000	2 → $S = \{2, 3\}$ +3000	1 → $S = \{1, 2, 3\}$ +6000	+3000

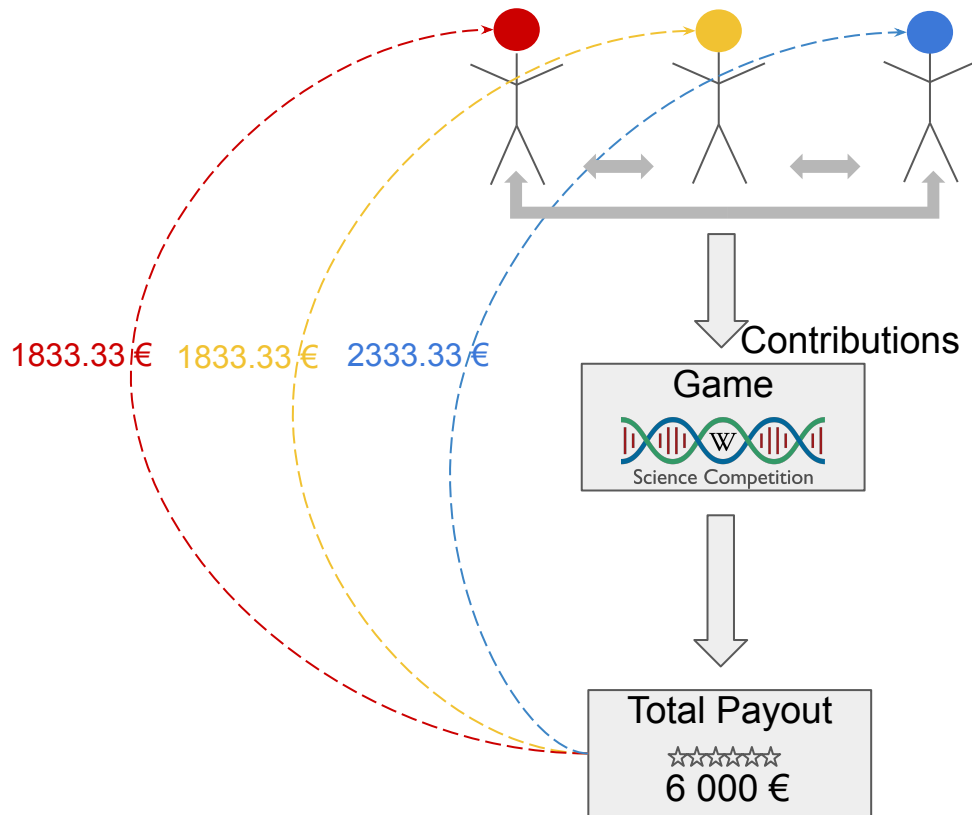
Shapley value of player 3  : +2333.33

Players interact

(payouts ☆ do not add up)

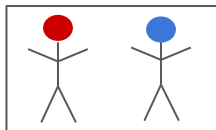


Players interact

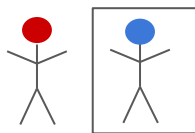


via sets

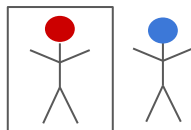
$|S| = 2$
weight = $2/6$



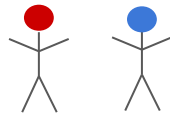
$|S| = 1$
weight = $1/6$



$|S| = 1$
weight = $1/6$

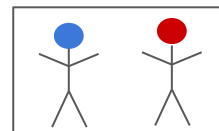


$|S| = 0$
weight = $2/6$

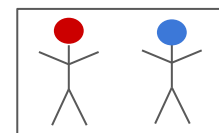


via orders

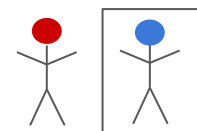
$|S| = 2$
weight = $1/6$



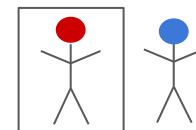
$|S| = 2$
weight = $1/6$



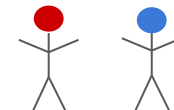
$|S| = 1$
weight = $1/6$



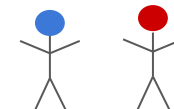
$|S| = 1$
weight = $1/6$



$|S| = 0$
weight = $1/6$

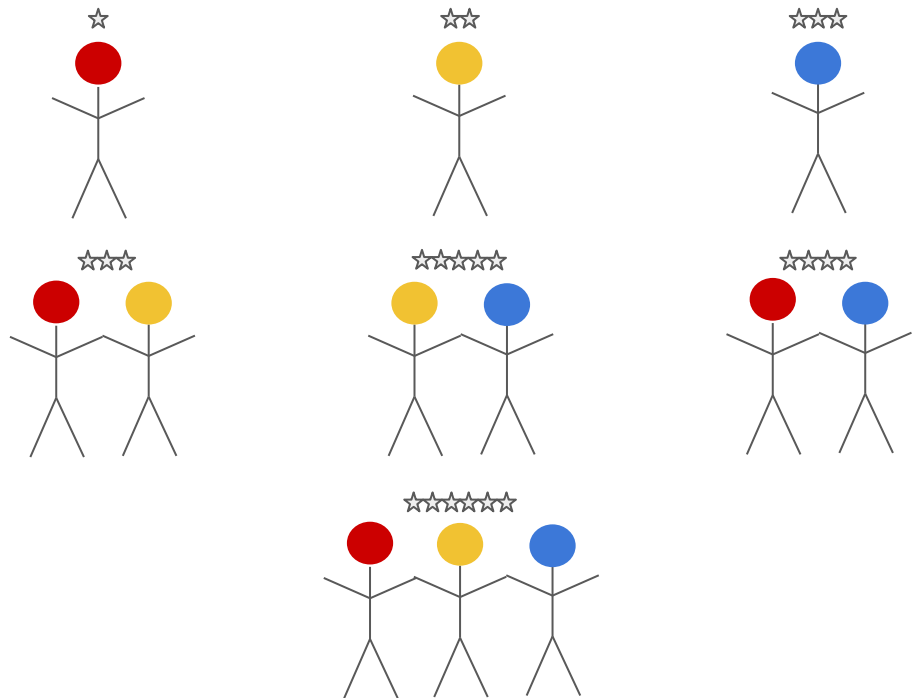


$|S| = 0$
weight = $1/6$

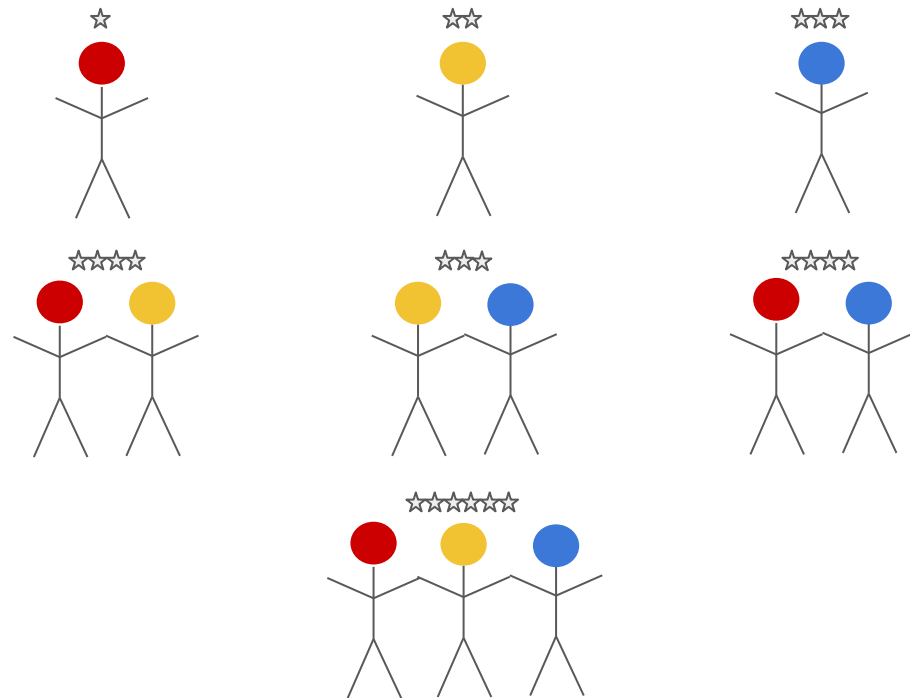


Players do not interact

(payouts ☆ add up in each coalition)

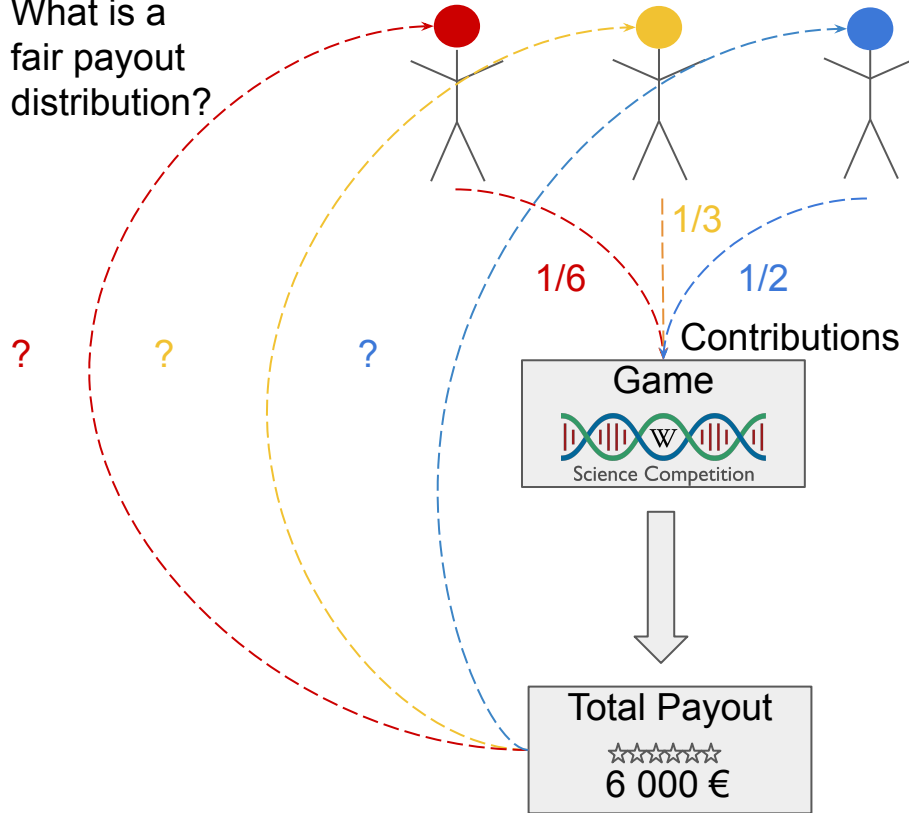


Players interact

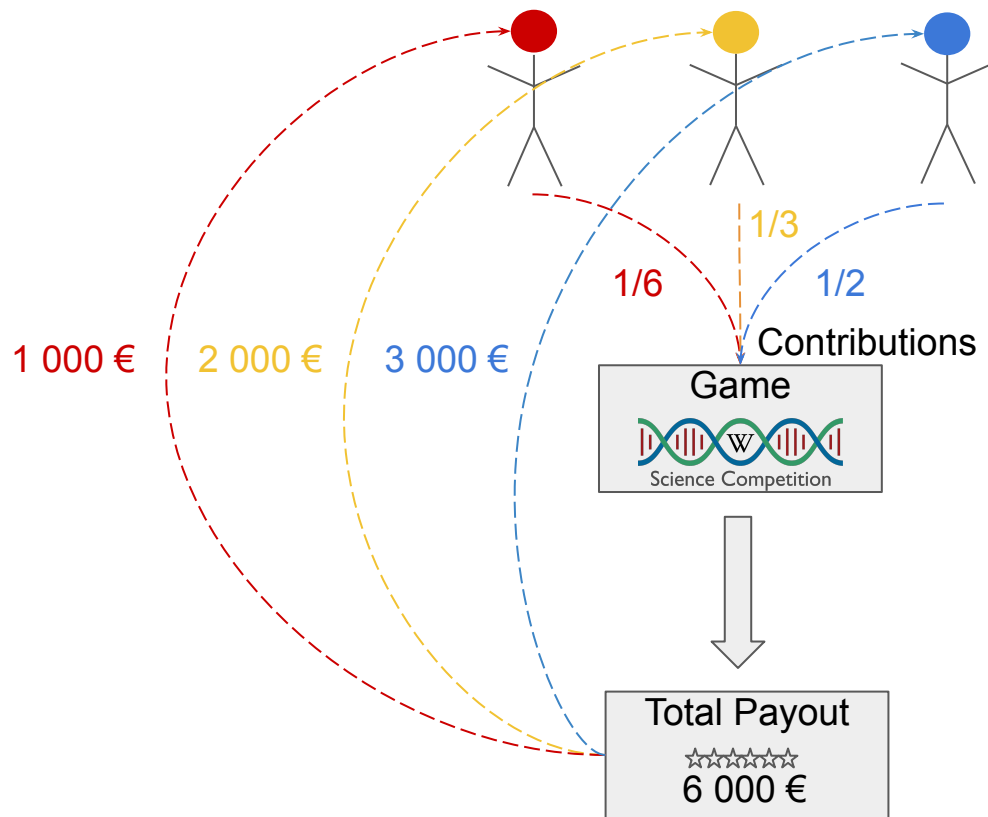


Players do not interact

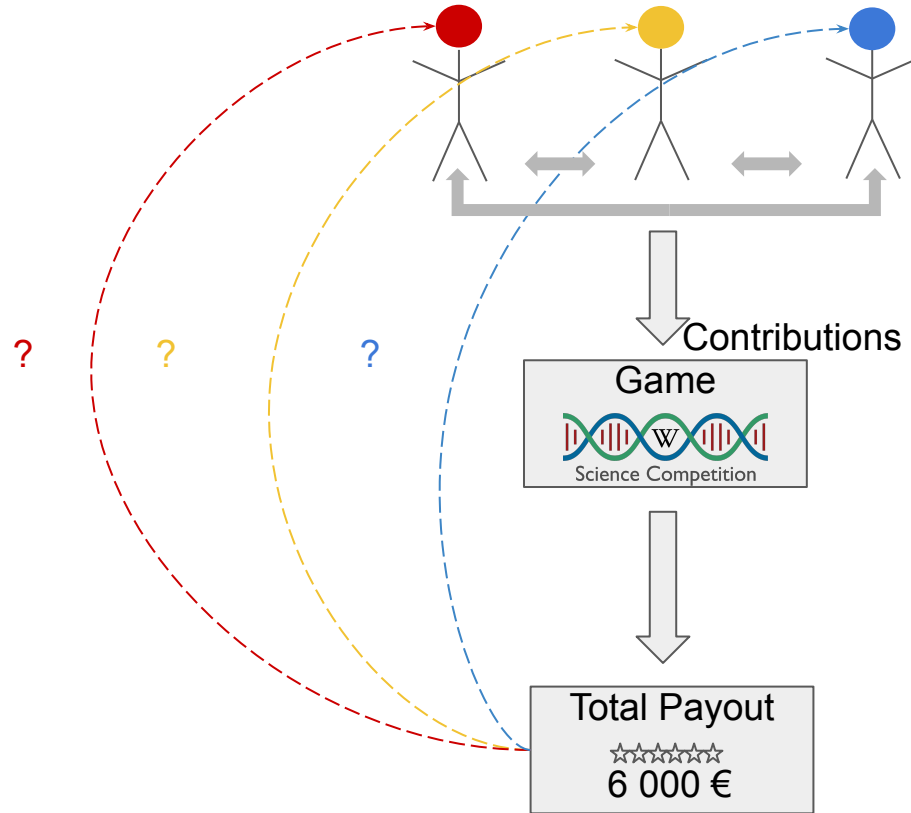
What is a
fair payout
distribution?



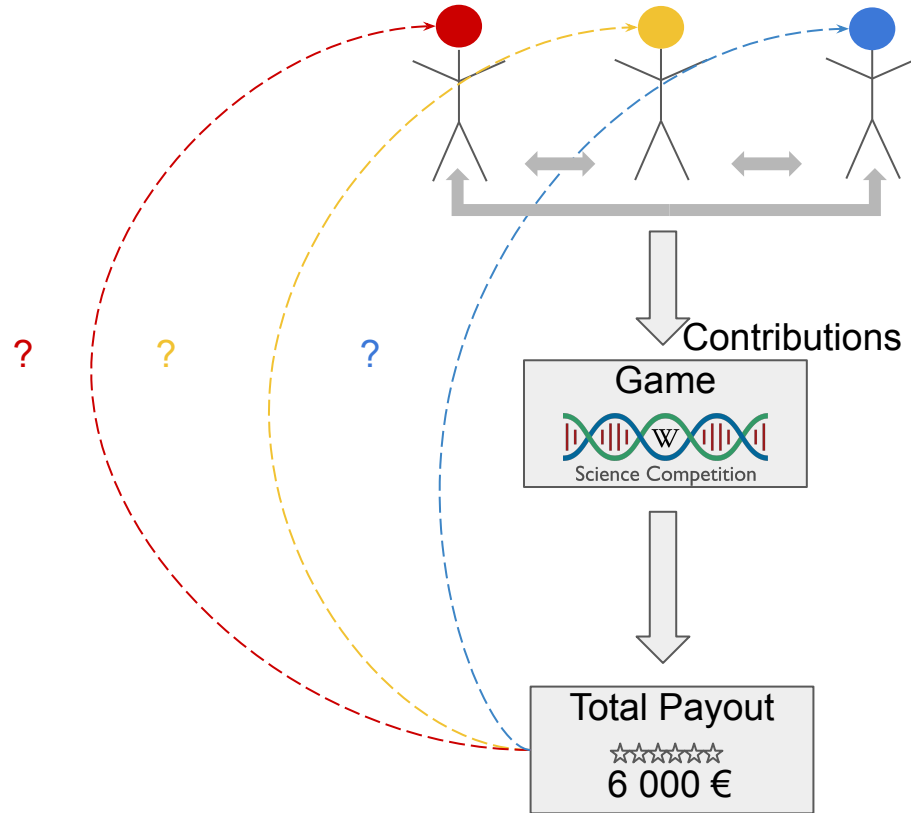
Players do not interact



Players interact



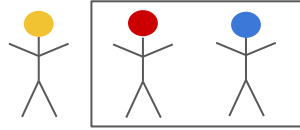
Players interact



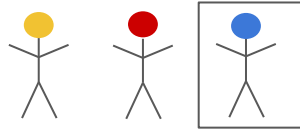
All coalitions of players without



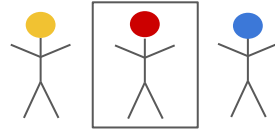
$|S| = 2$
weight = $2/6$



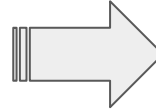
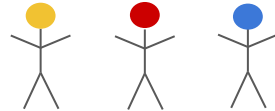
$|S| = 1$
weight = $1/6$



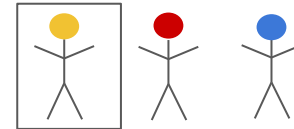
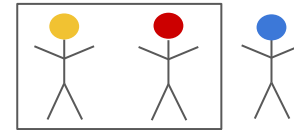
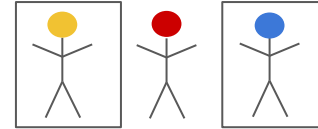
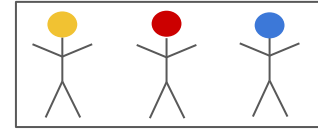
$|S| = 1$
weight = $1/6$




$|S| = 0$
weight = $2/6$
(empty coalition)



Add to the coalition



- Compute total payout of each coalition
- Compute difference in total payout for each coalition with and without player 
- Sum up weighted differences in total payout