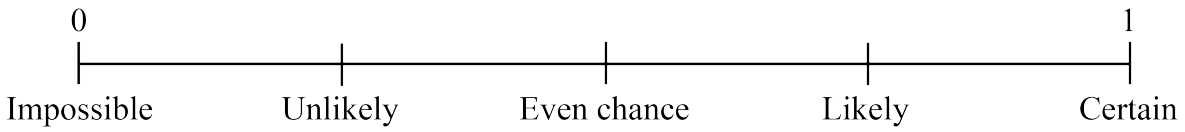
Problem of the Week
Problem B and Solution
On-Base Probabilities

Problem

In baseball, OBP stands for On-Base Percentage. It is the number of times the player makes it on base divided by the total number of times they step up to bat, rounded to three decimal places. For 10 players in the MLB, suppose we have the following OBP statistics.

Player	**OBP**
Jake Bauers	0.357
Vladimir Guerrero	0.500
Ian Happ	0.156
Kyle Schwarber	0.278
Andrew Vaughn	0.267
Alex Call	0.857
Jarren Duran	0.091
Aaron Judge	0.581
Sal Stewart	0.600
Masataka Yoshida	0.571

(a) Order the given OBP data on the probability line below from least likely to get on base to most likely to get on base.



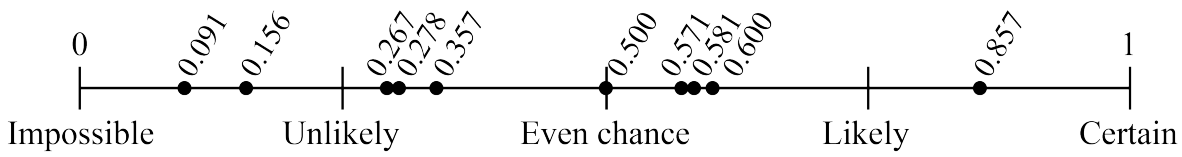
(b) Choose any three of the ten players and answer the questions that follow. If they step up to bat 10 times, how many times would you expect each of these three players to get on base? What about 20 times at bat? 25 times?

(c) What would be a reasonable explanation for the OBP of Jasson Dominguez, a brand new player with an incredible OBP of 1.000?

(d) A new player has an OBP of 0.400 after 10 times at bat, but wants to increase their OBP to 0.550. How many times must they make it on base in their next 10 times at bat?

Solution

(a) The given OBP data is shown in order on the probability line below. Jarren Duran is least likely to get on base and Alex Call is most likely.



(b) If a player steps up to bat n times, the number of times you would expect them to make it on base is equal to n multiplied by their OBP, rounded to the nearest whole number. The results for $n = 10$, 20, and 25 times at bat (AB) are in the table for all the players; find your chosen three.

Player	**OBP**	**10 AB**	**20 AB**	**25 AB**
Jake Bauers	0.357	4	7	9
Vladimir Guerrero	0.500	5	10	13
Ian Happ	0.156	2	3	4
Kyle Schwarber	0.278	3	6	7
Andrew Vaughn	0.267	3	5	7
Alex Call	0.857	9	17	21
Jarren Duran	0.091	1	2	2
Aaron Judge	0.581	6	12	15
Sal Stewart	0.600	6	12	15
Masataka Yoshida	0.571	6	11	14

(c) Since Jasson Dominguez is a brand new player, his incredible batting average of 1.000 likely means that he has had very few times at bat and has made it on base every time.

(d) For an OBP of 0.55 after 20 times at bat, we need $\frac{n}{20} = 0.55$, where n is the total number of times on base. Thus, $n = 20 \times 0.55 = 11$ times on base. Since the player already has a batting average of 0.4 after 10 times at bat, they have made it on base $0.4 \times 10 = 4$ times. Thus, the player needs to make it on base 7 more times in their next 10 times at bat.