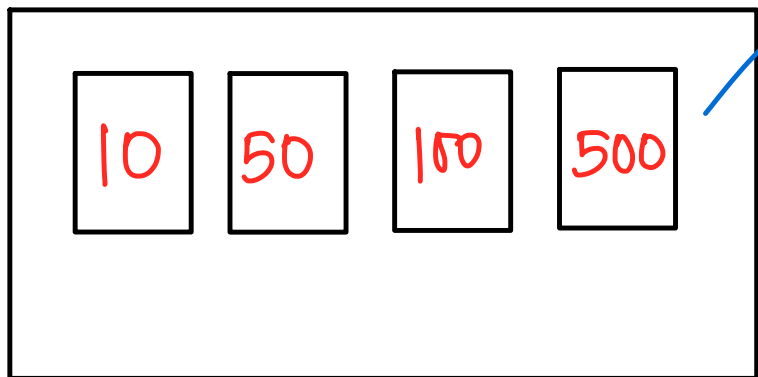


Random Variable  
and  
Expected Values

Box containing 4 Currencies



Randomly drawing a currency  
(each currency is equally likely)

denoting Amount  $\rightarrow X$

'X' is a Random amount  
 $\rightarrow$  Random Variable  $\rightarrow$  RV

What is the average amount we likely to get when we draw a currency from the box?

average amt. = Simple mean

$$= \frac{10 + 50 + 100 + 500}{4}$$
$$= 165 \text{ Rs.}$$

Average amount  $\rightarrow$  Expected value of RV 'X'

$E(X)$   $\rightarrow$  Expected value of 'X'

Probability of picking any currency  
( $p = \frac{1}{4} = 0.25$ )

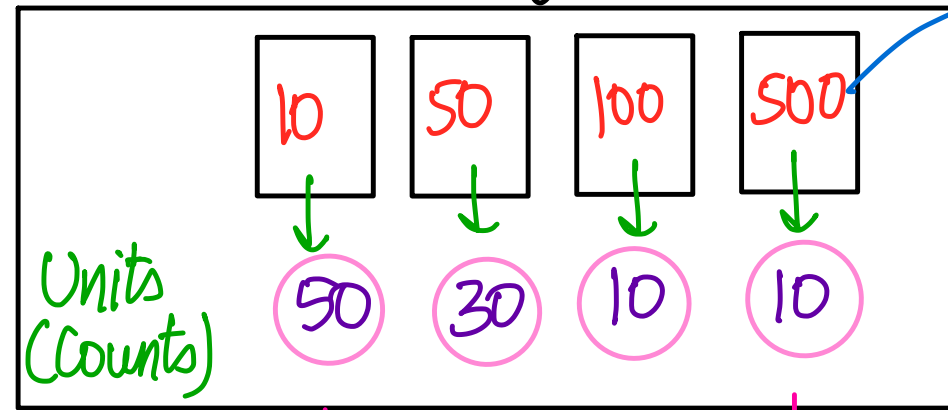
$$E(X) = \left(10 \times \frac{1}{4}\right) + \left(50 \times \frac{1}{4}\right) + \left(100 \times \frac{1}{4}\right) + \left(500 \times \frac{1}{4}\right)$$

$$E(X) = \sum_i X_i \cdot p(X_i)$$

## Box containing 4 Currencies

Randomly drawing a currency  
(each currency is NOT equally likely)

denoting Amount  $\rightarrow X$   
'X' is a Random amount  
 $\rightarrow$  Random Variable  $\rightarrow RV$



Total Units = 100

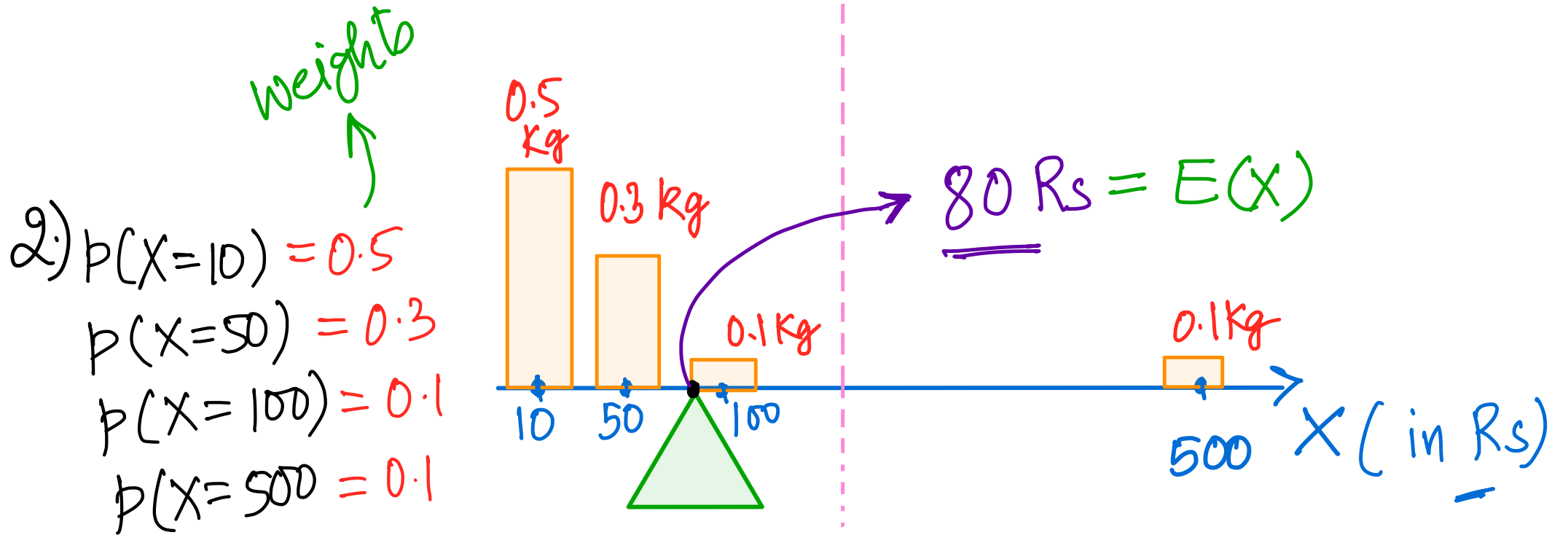
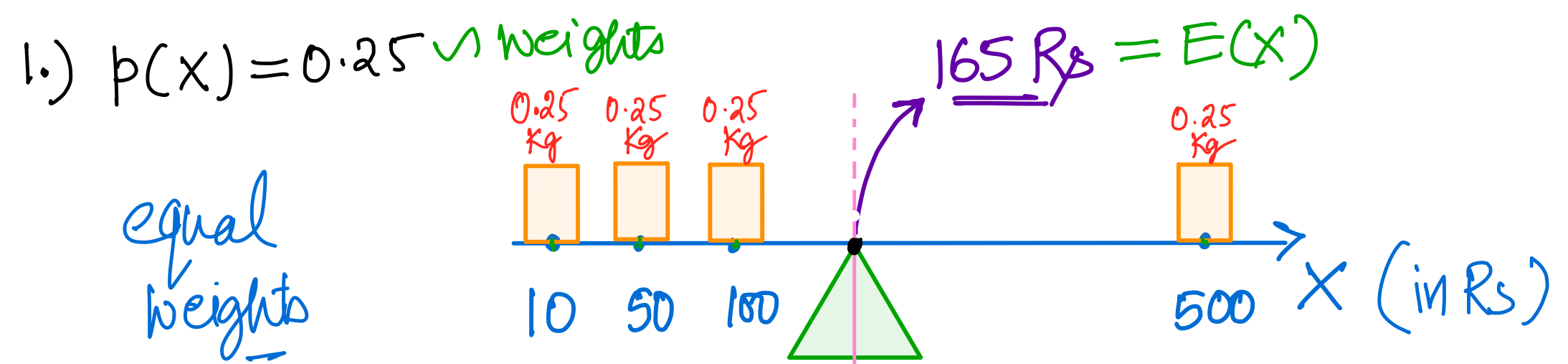
- What is the average amount / Expected Amt we likely to get when we draw a currency from the box?

$X_i$	$p(X_i)$
10	$50/100 = 0.5$
50	$30/100 = 0.3$
100	$10/100 = 0.1$
500	$10/100 = 0.1$

$$E(X) = \sum X_i \cdot p(X_i)$$

$$E(X) = (10 \times 0.5) + (50 \times 0.3) + (100 \times 0.1) + (500 \times 0.1)$$

$$E(X) = 80 \text{ Rs.}$$



$\Rightarrow E(X) = \text{Weighted Mean or Weighted Average}$

SQL Queries are equally likely to:

- a) Execute successfully in 1 minute,
- b) Fail at 3 minutes

Upon failure, we run the query again till it is successful. Find the expected time to run this query

Random Variable

time

'X'

to success

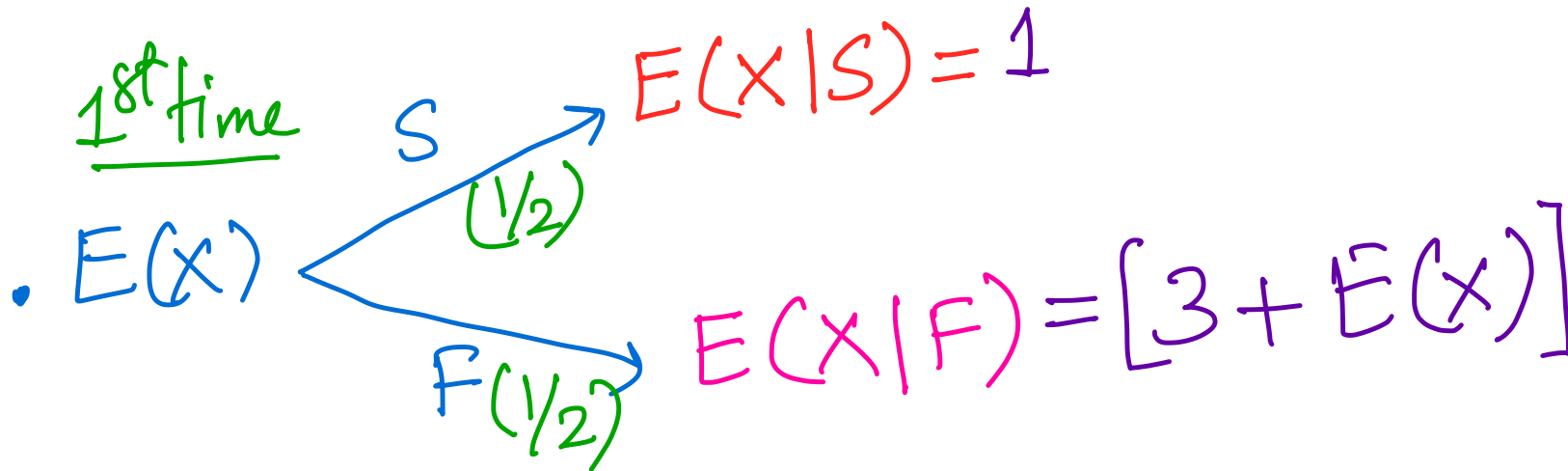
Sol<sup>n</sup>

Success : S, FS, FFS, FFFS, FFFFS, - - - -

Sequences

X : 1, 4, 7, 10, 13, 16, 19, - - - -

1<sup>st</sup> time



•  $E(X) = \sum X_i P(X_i)$   $\rightarrow X_i \rightarrow 1$   
 $\rightarrow 3 + E(X)$

$$E(X) = \left(1 \times \frac{1}{2}\right) + \left((3 + E(X)) \times \frac{1}{2}\right)$$

$$\Rightarrow 2E(X) = 1 + 3 + E(X)$$

$$E(X) = 4 \text{ min} *$$