

# Statistics for Data Science -1

## Lecture 8.5: Discrete Random Variable: Graph of probability mass function

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# Learning objectives

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1. Define what is a random variable.

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3. Probability mass function, graph, and examples.
4. Cumulative distribution function, graphs, and examples.

## Learning objectives

1. Define what is a random variable.
2. Types of random variables: discrete and continuous.
3. Probability mass function, graph, and examples.
4. Cumulative distribution function, graphs, and examples.
5. Expectation and variance of a random variable.

## Probability mass function, graph, and examples

Probability mass function

Graph of probability mass function



## Graph of probability mass function

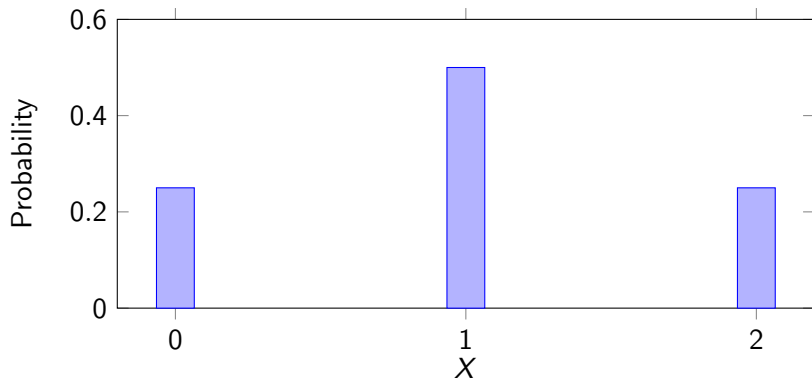
- ▶ It is helpful to illustrate the probability mass function in a graphical format by plotting  $P(X = x_i)$  on the  $y$ -axis against  $x_i$  on the  $x$ -axis.
- ▶ Let's look at a few examples

## Example

$X$	0	1	2
$P(X = x_i)$	0.25	0.5	0.25

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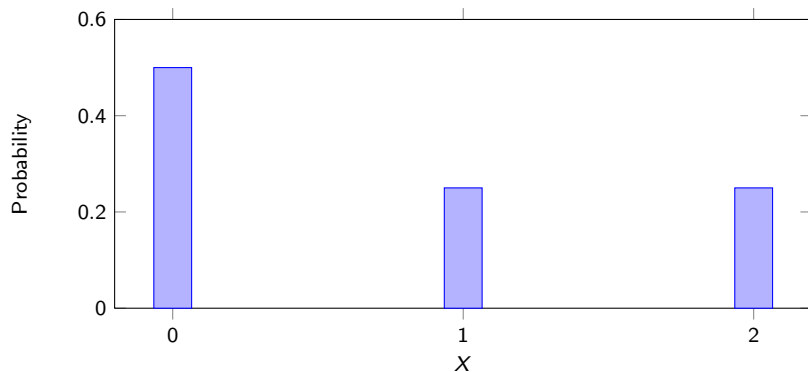


## Example

$X$	0	1	2
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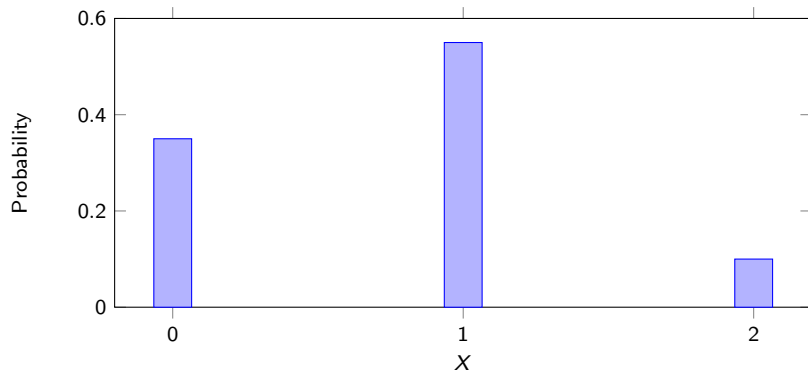


## Example

$X$	0	1	2
$P(X = x_i)$	0.35	0.55	0.10

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- └ Probability mass function, graph, and examples
  - └ Graph of probability mass function

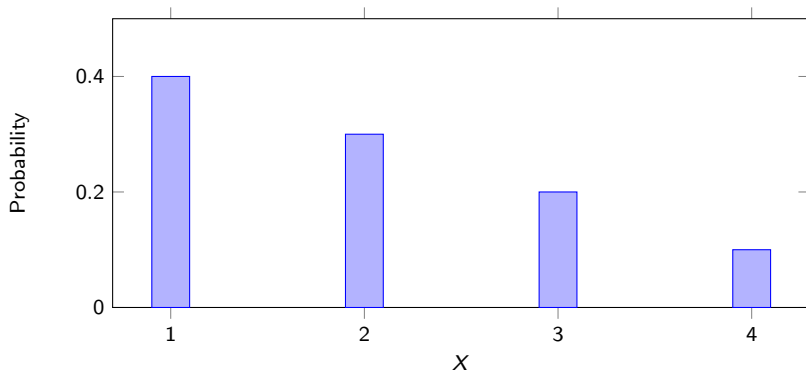
## Example: positive skewed distribution

$X$	1	2	3	4
$P(X = x_i)$	0.4	0.3	0.2	0.1



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$X$	1	2	3	4
$P(X = x_i)$	0.4	0.3	0.2	0.1

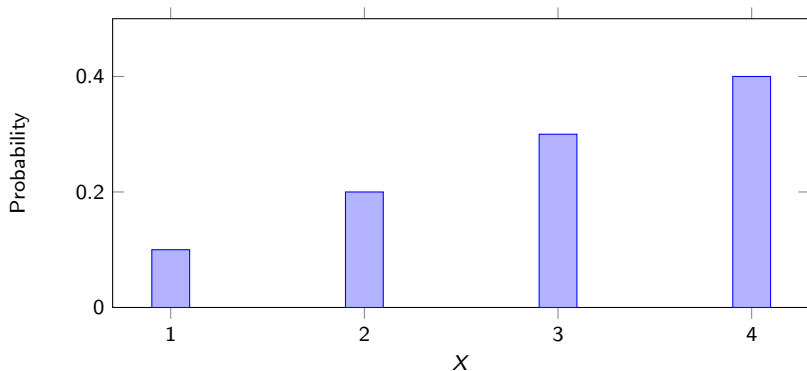


## Example: negative skewed distribution

$X$	1	2	3	4
$P(X = x_i)$	0.1	0.2	0.3	0.4

## Example: negative skewed distribution

$X$	1	2	3	4
$P(X = x_i)$	0.1	0.2	0.3	0.4



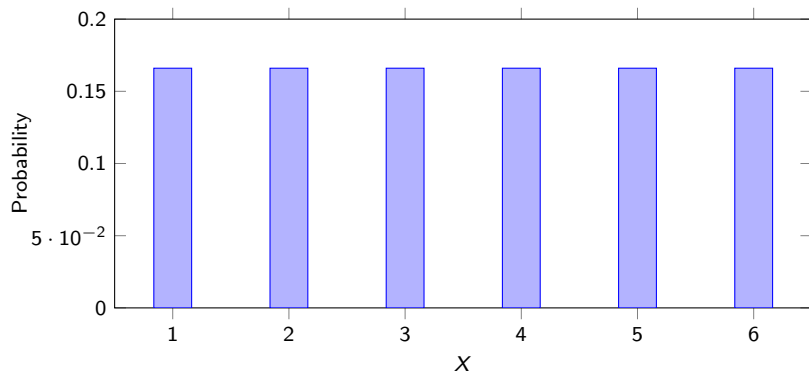
- └ Probability mass function, graph, and examples
  - └ Graph of probability mass function

## Rolling a dice once: $X$ outcome

$X$	1	2	3	4	5	6
$P(X = x_i)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

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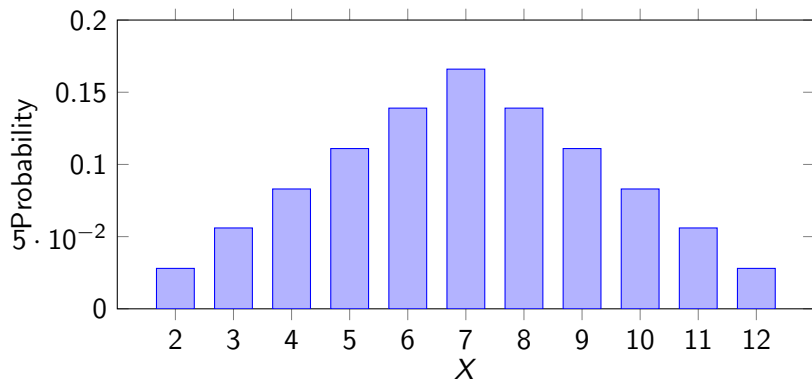
- └ Probability mass function, graph, and examples
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## Rolling a dice twice: $X$ -sum of outcomes

$X$	2	3	4	5	6	7	8	9	10	11	12
$P(X = x_i)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

## Rolling a dice twice: $X$ -sum of outcomes

$X$	2	3	4	5	6	7	8	9	10	11	12
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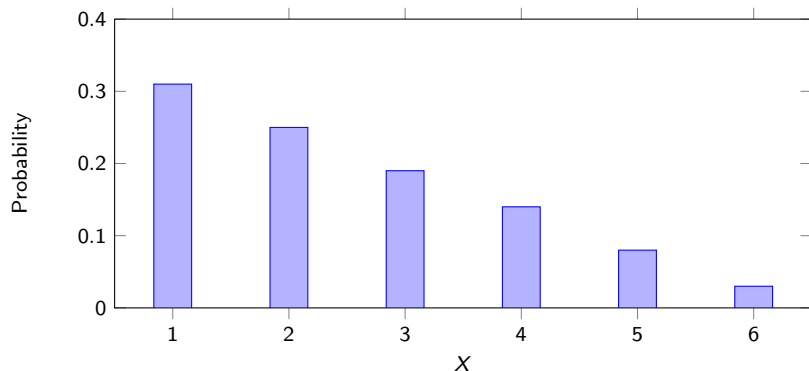
## Rolling a dice twice: $X$ -smaller of outcomes

$X$	1	2	3	4	5	6
$P(X = x_i)$	$\frac{11}{36}$	$\frac{9}{36}$	$\frac{7}{36}$	$\frac{5}{36}$	$\frac{3}{36}$	$\frac{1}{36}$



## Rolling a dice twice: $X$ -smaller of outcomes

$X$	1	2	3	4	5	6
$P(X = x_i)$	$\frac{11}{36}$	$\frac{9}{36}$	$\frac{7}{36}$	$\frac{5}{36}$	$\frac{3}{36}$	$\frac{1}{36}$

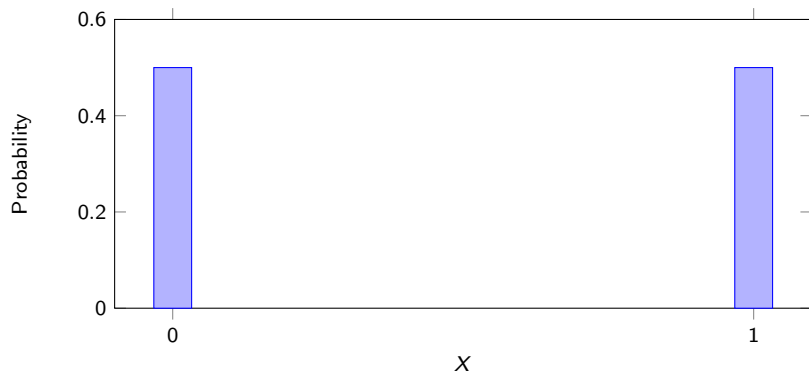


## Toss a coin once: $X$ - outcome

$X$	0	1
$P(X = x_i)$	0.5	0.5

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$X$	0	1
$P(X = x_i)$	0.5	0.5

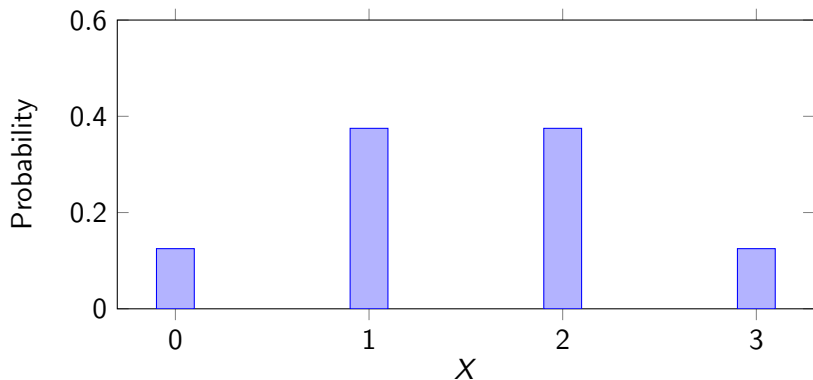


## Tossing a coin thrice: $X$ -number of heads

$X$	0	1	2	3
$P(X = x_i)$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

## Tossing a coin thrice: $X$ -number of heads

$X$	0	1	2	3
$P(X = x_i)$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

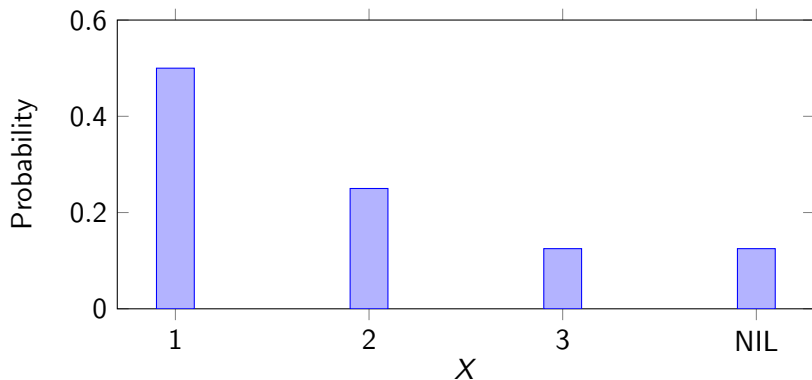


## Tossing a coin thrice: $X$ -toss head appearing first

$X$	1	2	3	NIL
$P(X = x_i)$	$\frac{4}{8}$	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{1}{8}$

## Tossing a coin thrice: $X$ -toss head appearing first

$X$	1	2	3	NIL
$P(X = x_i)$	$\frac{4}{8}$	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{1}{8}$



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## Section summary

- Graph of p.m.f and examples