V. Probability Distribution

The _probability distribution_ is a display of the list of events and each of event's probability. Usually, it is a table. (It can be from a graph.)

— random variable: It is a variable that has a single and a numerical value, determine by chance of the event.

eg rolling a die ⟵ spots come up

eg drawing a poker-hand ⟵ cards do not change

eg the weather ⟵ nature

eg grades ⟵ different level of difficulty

eg height ⟵ very common

eg winning on a sport game ⟵ "49ers wins"

⋮

eg many events that were _not_ purposely created or in control

eg

Scores	Probability
50-59	0.2
60-69	0.25
70-79	0.3
80-89	0.1
90-99	0.1
100-100	0.05

Note: It is for finding <u>expected value</u>, <u>parameters</u> and <u>binomial distribution</u>.

– Requirement: 1. The random variable x has a probability, <u>namely $P(x)$</u>.

2. Each $P(x)$ is within $[0, 1]$.

3. Sum of $P(x)$, which is $\sum P(x) = 1$.

$$P(x_1) + P(x_2) + \cdots P(x_n) = 1$$

eg   Determine which, if any, of the following distributions is a Discrete Probability Distribution. For any that are not Discrete Probability Distributions, state why they are not.

A)

x	P(x)
0	.24
1	.46
2	.40

B)

x	P(x)	
2	.38	✓
3	.40	✓
4	.22	✓

$P(x)$ ✓
$0 \le P(x) \le 1$
$\sum P(x) = 1$

C)

x	P(x)
1	−.20
2	.70
3	.50

$P(1) = -0.2$ ✗

D)

x	P(x)
7	.34
8	?
9	.26

← missing

<u>not</u> the complement

missing Prob.

S: $\sum P(x) \ne 1$

No

Yes

No

No

eg Given the Probability distribution below:

x	P(x)

Find: a   P(x > 4)

do <u>not</u> forget 0

x	P(x)
0	.05
1	.10
2	.30
3	.25
4	.20
5	.10

Find: a. $P(x \geq 4)$

b. $P(x < 3)$

c. $P(1 \leq x < 3)$

do **not** forget 0

S: a. $P(x \geq 4) = P(4 \text{ or } 5)$ ← may skip

$= P(4) + P(5) - P(4 \text{ and } 5)$ may skip

$= 0.20 + 0.10 \quad - \quad 0$

$= \boxed{0.30}$

← no such probability

$x \geq 4$
$4 \overset{?}{\geq} 4 \checkmark$
$5 \geq 4$

b. $P(x < 3) = P(0 \text{ or } 1 \text{ or } 2)$

$= P(0) + P(1) + P(2)$

$= 0.05 + 0.10 + 0.30$

$= \boxed{0.45}$

x	P(x)
0	.05
1	.10
2	.30
3	.25
4	.20
5	.10

$3 \overset{?}{<} 3$
NO

c. $P(1 \leq x < 3) = P(1 \text{ or } 2)$

$= P(1) + P(2)$

$= 0.10 + 0.30$

$= \boxed{0.40}$

$1 \overset{?}{\leq} 1 \overset{\checkmark}{<} 3$
$1 \leq 2^{\checkmark} < 3$
$1 \overset{\checkmark}{\leq} 3^{x} < 3$

eg Given the probability distribution below:

x	P(x)
0	.05
1	.10
2	.30
3	.25
4	.20
5	.10

Find: a. $P(x$ is no less than 4)

b. $P(x$ is no greater than 2)

c. $P(x$ is more than 4)

S: a. $P(x$ is no less than 4)

$= P(4 \text{ or } 5)$

$= P(4) + P(5)$

$= 0.20 + 0.10$

$= \boxed{0.30}$

no less than 4 ?

1st: less than 4 : 0
1
2
3
※

2nd: no less than 4: 4
5

not 0,1,3,3
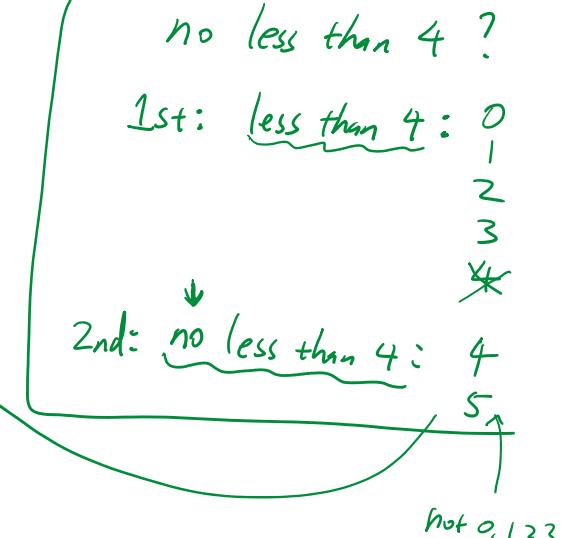
b. $P(x$ is no greater than 2)
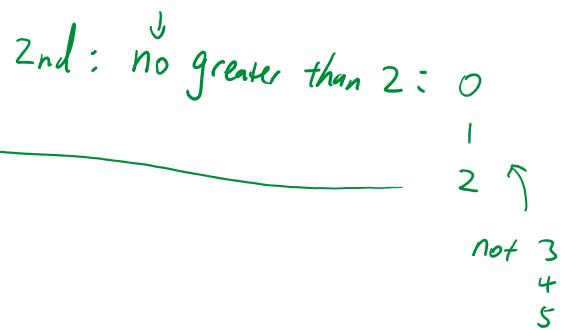
$= P(0) + P(1) + P(2)$

$= 0.05 + 0.10 + 0.30$

$= \boxed{0.45}$

x	P(x)
0	.05
1	.10
2	.30
3	.25
4	.20
5	.10

1st: greater than 2 : ※
3
4
5

2nd: no greater than 2: 0
1
2

not 3
4
5

c. $P(x$ is more than 4)

C. $P(x \text{ is more than } 4)$

$= P(5)$

$= \boxed{0.10}$

x	P(x)
0	.05
1	.10
2	.30
3	.25
4	.20
5	.10

4 more than 4 ?

No.

5 ✓