Section 5 – 1B: **Discrete Probability Distribution Tables**

Probability Table Notation

x is a random variable that represents all the possible outcomes when a procedure or experiment is performed. The Probability Distribution Table below represents the probability values P(x) for the number of cars owned by families that live in Folsom. **The values of P(x) are stated in decimal form** but a "person who is not trained in statistics" often refers to these values as a percent.

Car Ownership in Folsom

x: number of cars per family	P(x)
0	.08
1	.28
2	.48
3	.16

Using a Probability Distribution Table to predict the probability for a single value of x

P(x) is the probability of getting that x value
when you **select one value from the n values in the population.**

P(0)

P(0) = .08 This means that if I **select 1 family** in Folsom, the probability that that family will own 0 cars is .08. You might say that if I ask **one family** in Folsom how many cars they own, I have a **8% chance of getting an answer of 0 cars.**

P(1)

P(1) = .28 This means that if I **select 1 family** in Folsom, the probability that that family will own 1 car is .28. You might say that if I ask **one family** in Folsom how many cars they own, I have a **28% chance of getting an answer of 1 car.**

P(2)

P(2) = .48 This means that if I **select 1 family** in Folsom, the probability that that family will own 2 cars is .48. You might say that if I ask **one family** in Folsom how many cars they own, I have a **48% chance of getting an answer of 2 cars.**

P(3)

P3) = .16 This means that if I **select 1 family** in Folsom, the probability that that family will own 3 cars is .16. You might say that if I ask **one family** in Folsom how many cars they own, I have a **16% chance of getting an answer of 2 cars.**

Special Cases of P(x)

P(x) = 0

P(x) can be 0 for an x value. If P(4) = 0 than **no families in Folsom owns 4 cars**. There is **NO CHANCE** that a family will answer that they own 4 cars.

$P(x) = 0^+$

Some values of P(x) are very small. For example P(x) = .00034 is a value that rounds off to .00 if we round to two decimal places. We say P(x) = $\mathbf{0^+}$ instead of P(x) = 0. A value of 0 would mean that there is **no chance** of getting an x value. $\mathbf{0^+}$ indicates that there is some probability of getting the x value but it is very small.

P(x) cannot negative

The P(x) is found by dividing the number of ways that x happens by the total of all the outcomes. Neither of these values can be negative so the value of P(x) cannot be negative.

The basic requirements for a Probability Distribution Table

1. The total of all the P(x) values must be equal to 1. $\sum P(x) = 1$

Note: Due to round off error the total of all the P(x) values may be off by a small amount (normally .01). If this is the case, a note stating that the **total is off due to round off error** should be included.

2. Each P(x) will be a decimal greater than or equal to 0 and less than or equal to 1.

$$0 \le P(x) \le 1 \quad \text{for each } P(x)$$

Examples

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

No
$\sum P(x)$
does not total 1

B)

x	P(x)
2	.38
3	.40
4	.22

Yes
$\sum P(x) = 1$ **and**
$0 \le P(x) \le 1$
for each p(x)

C)

x	P(x)
1	–.20
2	.70
3	.50

NO
$\sum P(x)$ **= 1**
but one P(x)
is negative

D)

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

If ? = 40
then the table is
a Discrete Probability Distribution.

Using a Probability Distribution Table to predict the Probability for a Range of Values

The sum of all the values of P(x) for a desired range of x values is the probability that **a value of x in that range will occur when** you select **one value from the n values** in the population.

Example 1

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

$P(x \geq 4) = P(4) + P(5)$ = **.20** + **.10** = **.30**

If I **select 1 number** from the population, the probability that the number selected will be **4 or greater** is **.30**

$P(x < 3) = P(0) + P(1) + P(2)$ = **.05** + **.10** + **.30** **= .45**

If I **select 1 number** from the population, the probability that the number selected will be **less than 3** is **.45**

$(1 \leq x < 3) = P(1) + P(2)$ = **.10** + **.30** **= .40**

If I **select 1 number** from the population, the probability that the number selected will be greater than or equal to 1 and **less than 3** is **.40**

Example 2

x:	P(x)
0	**.05**
1	**.15**
2	**.20**
3	**.30**
4	**.20**
5	**.10**

P(x is **no less than 4**) = $P(4) + P(5)$= **.20 + .10**

P(x is **no less than 4**) = **.30**

P(x is **no greater than 2**) = $P(0) + P(1) + P(2)$= **.05 + .15 + .20**

P(x is **no greater than 2**) = **.40**

P(x is **between 1 and 4**) = $P(2) + P(3)$= **.20 + .30**

P(x is **between 1 and 4**) = **.50**

P(x is **between 2 and 4 inclusive**) = $P(2) + P(3) + P(4)$= **.20 + .30 + .20**

P(x is **between 2 and 4 inclusive**) = **.70**

