Our last chapter [I think] in IBSL

Statistical Distributions – Discrete Random variables

A random variable represents, in number form, the possible outcomes for some random experiment.

A discrete random variable, X, has possible values $x = 0, 1, 2, 3, 4, \ldots$

Example: the number of colleges that a high school student applies to or the number of cracked eggs in a carton

In mathematics, "discrete" means "countable"

A continuous random variable, X, has all possible values in some interval.

Example: the age of students could be in the interval $11 \le x \le 21$

Sometimes, "continuous" implies "measurable"

Let's classify:

Random variable	**Continuous**	**Discrete**
Number of bears in the woods		✓
Height of a bear	✓	
Grade on a "maths" test		✓

Number of students who took a “maths” test		✓
Weight of a student who took a “maths” test	✓	
Number of hairs on a student who took a “maths” test		✓
Number of coins in a student’s pocket		✓

For ANY random variable, there is a probability distribution associated with it.

Our new notation:

$P(X = x)$

Here’s what a typical problem looks like:

A “maths” student is playing a game where a turn consists of throwing a dice and then moving the number of squares on the playing board equal to the score on the dice.

In this case, $X =$ the number of squares moved in a turn

$P(X = 3)$ means “the probability that they move 3 squares on the playing board

For a fair die our Probability Distribution will look like:

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

What would the Probability Distribution look like for the following:
Two dice are thrown and the number, X , is the sum of the dice which are equal to the number of squares that are moved.

How many different sums are possible? 11

Based on our previous chapter, what are they probabilities?

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

Notice that the sum of $P(X = x)$ is equal to one.

For each random variable there is a probability distribution, p_i, where $0 \leq p_i \leq 1$ AND $\sum_{i=1}^{n} p_1 = 1$.

We can represent our probability distribution of a discrete random variable by using a table, or a graph, or in function form.

Let's look at some examples in our textbook!
See Example 2 on page 712

Notice that the probability distribution is shown in both table and graph form.

See Example 3 on page 713. This one is a little trickier.

(a) $P(X = x) = \dfrac{x^2 + 1}{34}$ for $x = 1, 2, 3, 4$

Let's make a table:

x	1	2	3	4
$P(X = x)$	$\frac{2}{34}$	$\frac{5}{34}$	$\frac{10}{34}$	$\frac{17}{34}$

Now let's find $\sum P(i)$ $= 1$

(b) $P(X = x) = C^{3}_{x}\,(0.6)^{x}\,(0.4)^{3-x}$ for $x = 0, 1, 2, 3$

x	0	1	2	3
$P(X = x)$	$\binom{3}{0}(.6)^3(.4)^0$	$\binom{3}{1}(.6)^2(.4)^1$	$\binom{3}{2}(.6)^1(.4)^2$	$\binom{3}{3}(.6)^0(.4)^3$

Now let's find $\sum P(i)$ $= 1$

You try:
Page 714 #7

Homework: page 711 #4 AND pages 712-714 #1, 2, 4, 5, 6