IB Math SL **Probability Distributions**

Unit 5, Day 6 Notes

1. **Random Variables:**

A lot of our work thus far has mainly used words. It is more convenient, when possible, to use numbers.

Again, we have 2 types, discrete and continuous. What is the difference?

**Ex:** Classify the following random variables as continuous or discrete:

1. The quantity of fat in a lamb chop.
2. The mark out of 50 for a geography test
3. The weight of a 17 year old boy
4. The volume of water in a cup of coffee
5. The number of trout in a lake
6. The number of hairs on a cat
7. The length of hair on a horse
8. The height of a building

X is called a discrete random variable if it has the following properties:

* X takes values x1, x2, x3, …, xn
* Each value of X is associated with a probability, P(X = xi)
* 

Consider throwing a regular die: the random variable, X, can take the values 1, 2, 3, 4, 5, 6, so

X = { } and to each of these values is assigned the probability \_\_\_\_\_\_.

What is the sum of all of those probabilities?

1. **Discrete Probability Distributions:**

When we assign probabilities to each random variable, it is called the PROBABILITY DISTRIBUITION.

Probability Distributions can be given in

* Table form
* Graphical form
* Functional form

For example: Two coins are tossed. What are the possible outcomes?

Let’s say we assign the random variable to represent the number of tails. What are the possible outcomes?

What are the associated probabilities?

Show this distribution in a histogram:

**Ex :** Show that the following is a probability distribution function: for x =1,2,3,4.

**Ex 2:** The random variable, X, takes the probability distribution shown in the table, find the value of c.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | 0 | 1 | 2 | 3 | 4 |
| P(X = xi) | 1/5 | 1/6 | 3/10 | 1/5 | c |

1. **Expectation:**

Example: A die is rolled 120 times. On how many occasions would you expect the outcome to be a three?

In general: If there are n members of a sample and the probability of an event occurring is p *for each* member, then the expectation of the occurrence of that event, E(x) is

**Ex:** Each time a soccer player kicks for a goal he has a ¾ chance of being successful. In one game, he kicks for a goal 12 times. How many goals would you expect him to kick?

When the probability for each outcome varies, the E(x) =

**Ex 2:** A magazine store recorded the number of magazines purchased by its customers in one day. 23% bought one magazine, 38% bought two, 21% bought three, 13% bought four, and 5% bought five.

1. What is the random variable?
2. Make a random variable probability table
3. A customer walks into the store. How many magazines would you expect them to buy?

**Ex 3:** A bag contains 5 red marbles and 3 blue marbles which are randomly removed one at a time, without being replaced, until a red marble is removed.

1. Find the probability distribution of X, the number of marbles removed.
2. How many marbles would you expect to remove before getting a red?

**Ex 4:** An aircraft has three lavatories, each of which is occupied 40% of the time during a particular flight. Assuming that the lavatories are occupied independently,

1. Draw a table for the probability distribution of the number of lavatories which are occupied.
2. Find the expected number of occupied lavatories.

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