STA 3180 Statistical Modelling: Probability

Lecture Notes on Probability for STA 3180 Statistical Modelling

Probability is the branch of mathematics that deals with the likelihood of an event occurring. It is used to quantify the uncertainty associated with a given event. Probability theory is used to make predictions about the outcomes of experiments and to make decisions based on those predictions.

Key Concepts

- Probability is the measure of how likely an event is to occur.

- Probability can be expressed as a number between 0 and 1, where 0 indicates that the event is impossible and 1 indicates that the event is certain.

- The probability of an event is affected by other events that have already occurred or may occur in the future.

- Probability can be used to make predictions about the outcomes of experiments and to make decisions based on those predictions.

Definitions

- **Random Variable**: A random variable is a variable whose value is determined by chance.

- **Probability Distribution**: A probability distribution is a function that describes the probability of each possible outcome of a random variable.

- **Expected Value**: The expected value of a random variable is the average value of the random variable over many repetitions of the experiment.

- **Conditional Probability**: Conditional probability is the probability of an event occurring given that another event has already occurred.

Coding Examples

```
Start of Code
# Generate a random number between 0 and 1
import random
x = random.random()
print(x)
# Generate a random integer between 1 and 10
import random
x = random.randint(1, 10)
print(x)
# Calculate the expected value of a random variable
import numpy as np
```

```
x = np.array([1, 2, 3, 4, 5])
expected_value = np.mean(x)
print(expected_value)
# Calculate the conditional probability of an event
p_A = 0.4
p_B = 0.2
p_A_given_B = p_A * p_B / p_B
print(p_A_given_B)
End of Code
```

Practice Multiple Choice Questions

Q1. What is the probability of rolling a 6 on a standard six-sided die?

A. 1/6

Explanation: The probability of rolling a 6 on a standard six-sided die is 1/6, since there is only one 6 on the die.