Ch-4 Introduction to Python Modules

What is a Module?

A **module** is a file containing Python code (functions, variables, classes) which can be reused in other programs.
Python provides **built-in modules** (like math, random, statistics) and also allows you to create **user-defined modules**.

Importing a Module

1. Using import

This imports the whole module. Access members using module_name.function_name.

```
import math
print(math.sqrt(25))  # 5.0
```

2. Using from keyword

This imports specific functions/variables from the module. No need to use the module name as prefix.

```
from math import sqrt, pi
print(sqrt(16))       # 4.0
print(pi)             # 3.141592653589793
```

Built-in Modules

math Module

Used for mathematical operations.

Common functions:

Function	Description	Example
math.pi	Value of π (3.14...)	math.pi → 3.14159...
math.e	Euler's number	math.e → 2.71828...
math.sqrt(x)	Square root	math.sqrt(9) → 3.0
math.ceil(x)	Smallest integer ≥ x	math.ceil(4.2) → 5
math.floor(x)	Largest integer ≤ x	math.floor(4.8) → 4
math.pow(x,y)	x raised to power y	math.pow(2,3) → 8.0
math.fabs(x)	Absolute value	math.fabs(-3.5) → 3.5
math.sin(x)	Sine (in radians)	math.sin(math.pi/2) → 1.0
math.cos(x)	Cosine (in radians)	math.cos(0) → 1.0
math.tan(x)	Tangent (in radians)	math.tan(math.pi/4) → 1.0

Note: Angles must be in **radians**, not degrees.

random Module

Used to generate random numbers.

Common functions:

Function	Description	Example
random()	Random float from 0.0 to 1.0	random.random() → 0.73...
randint(a, b)	Random integer between a and b (inclusive)	random.randint(1, 6)
randrange(start, stop[, step])	Random number from range(start, stop)	random.randrange(1, 10, 2)

Example:

```
import random
print(random.randint(1, 100))  # Random integer between 1 and 100
```

statistics Module

Used for statistical calculations.

Common functions:

Function	Description	Example
mean(data)	Returns average	statistics.mean([1, 2, 3]) → 2
median(data)	Returns median	statistics.median([1, 3, 2]) → 2
mode(data)	Returns most frequent value	statistics.mode([2, 2, 3]) → 2

Example:

```
from statistics import mean, median, mode

data = [10, 20, 20, 30, 40]
print("Mean:", mean(data))      # 24
print("Median:", median(data))  # 20
print("Mode:", mode(data))      # 20
```