

## **Long Hour Coding Exam**

**Task:** Design and Implementation of a Python Package `signal_ICT_StudentName_EnrollmentNo` for Signal Generation and Operations.

### **Problem Statement:**

You are required to design a custom Python package named `signal_ICT_StudentName_EnrollmentNo` that demonstrates fundamental concepts of Signals and Systems. The package must be modular, containing three separate modules:

#### **1. unitary\_signals.py**

Implement the following functions:

- `unit_step(n)` – Generates a unit step signal.
- `unit_impulse(n)` – Generates a unit impulse signal.
- `ramp_signal(n)` – Generates a ramp signal.

Each function should return a NumPy array and plot the signal using matplotlib.

#### **2. trigonometric\_signals.py**

Implement the following functions:

- `sine_wave(A, f, phi, t)` – Generates a sine wave with amplitude  $A$ , frequency  $f$ , phase  $\phi$ , and time vector  $t$ .
- `cosine_wave(A, f, phi, t)` – Generates a cosine wave with similar parameters.
- `exponential_signal(A, a, t)` – Generates an exponential signal.

#### **3. operations.py**

Implement the following signal operations:

- `time_shift(signal, k)` – Shifts the signal by  $k$  units.
- `time_scale(signal, k)` – Scales the time axis of the signal by factor  $k$ .
- `signal_addition(signal1, signal2)` – Performs addition of two signals.
- `signal_multiplication(signal1, signal2)` – Performs point-wise multiplication of two signals.

### **Main Script (main.py)**

- Import the above modules from the package.
- Demonstrate the following tasks:
  1. Generate and plot a unit step signal and a unit impulse signal of length 20.
  2. Generate a sine wave of amplitude 2, frequency 5 Hz, phase 0, over  $t = 0$  to 1 sec.
  3. Perform time shifting on the sine wave by +5 units and plot both original and shifted signals.
  4. Perform addition of the unit step and ramp signal and plot the result.
  5. Multiply a sine and cosine wave of same frequency and plot the result.

**Expected Deliverables:**

1. Folder structure of the package:
2. signal\_ICT\_StudentName\_EnrollmentNo /
3. \_\_init\_\_.py
4. unitary\_signals.py
5. trigonometric\_signals.py
6. operations.py
7. main.py
8. Well-documented Python code with function definitions and comments.
9. Proper use of NumPy (for signal arrays) and Matplotlib (for plotting).
10. At least 3 plots showing signals and operations as per requirements.

**Student Submission Requirements:**

- The Wheel file (.whl) and source distribution (.tar.gz) inside a dist/ folder.
- A README.md explaining package modules, installation, and usage.
- A screenshot/PDF report showing:
  1. Successful local installation from wheel.
  2. Successful upload to TestPyPI.
  3. Successful installation from TestPyPI.
- GitHub repo link.

Reference Link: <https://www.youtube.com/watch?v=9Ii34WheBOA>

**Evaluation Criteria rubric (20 Marks):**

- Package Design & Modularity (5 Marks) – Proper structure with three modules.
- Correct Implementation of Signals (5 Marks) – Unitary & trigonometric signals.
- Correct Implementation of Operations (5 Marks) – Scaling, shifting, addition, multiplication.
- Main Script Demonstration (3 Marks) – Calling and plotting from all modules.
- Code Quality & Documentation (2 Marks) – Comments, readability, efficiency.

Githu link : [https://github.com/keshvi1234/PWP\\_LHC\\_28](https://github.com/keshvi1234/PWP_LHC_28)

**Subject: Programming with Python**

**Subject Code: 01CT1309**

**Student Name: Keshvi Santoki**

**Enrollment No:92510133028**

**Division: 3EK1**

Successful upload to TestPyPI.

```
PS E:\PWP\signal_ICT_Keshvi_92510133028> python -m twine upload dist/*
Uploading distributions to https://upload.pypi.org/legacy/
Enter your API token:
Uploading signal_ict_keshvi_92510133028-1.0.0-py3-none-any.whl
100% ───────────────────────────────── 10.1/10.1 kB • 00:00 • ?
Uploading signal_ict_keshvi_92510133028-1.0.0.tar.gz
100% ───────────────────────────────── 10.2/10.2 kB • 00:00 • ?

View at:
https://pypi.org/project/signal-ICT-Keshvi-92510133028/1.0.0/
PS E:\PWP\signal_ICT_Keshvi_92510133028>
```

Successful installation from TestPyPI.

```
C:\Users\kaavy>pip install signal-ICT-Keshvi-92510133028==1.0.0
Collecting signal-ICT-Keshvi-92510133028==1.0.0
  Downloading signal_ict_keshvi_92510133028-1.0.0-py3-none-any.whl.metadata (3.4 kB)
Requirement already satisfied: numpy>=1.19.0 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from signal-ICT-Keshvi-92510133028==1.0.0) (2.3.1)
Requirement already satisfied: matplotlib>=3.3.0 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from signal-ICT-Keshvi-92510133028==1.0.0) (3.10.5)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (1.3.3)
Requirement already satisfied: cycler>=0.10 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (4.59.2)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (1.4.9)
Requirement already satisfied: packaging>=20.0 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (25.0)
Requirement already satisfied: pillow>=8 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (11.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (3.2.3)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in c:\users\kaavy\appdata\local\programs\python\python313\lib\site-packages (from python-dateutil>=2.7->matplotlib>=3.3.0->signal-ICT-Keshvi-92510133028==1.0.0) (1.17.0)
Downloading signal_ict_keshvi_92510133028-1.0.0-py3-none-any.whl (2.7 kB)
Installing collected packages: signal-ICT-Keshvi-92510133028
Successfully installed signal-ICT-Keshvi-92510133028-1.0.0
```

Successful local installation from wheel.

```
PS E:\PWP\signal_ict_keshvi_92510133028> pip install .\dist\signal_ict_keshvi_92510133028-1.0.0-py3-none-any.whl
Processing e:\pwp\signal_ict_keshvi_92510133028\dist\signal_ict_keshvi_92510133028-1.0.0-py3-none-any.whl
Requirement already satisfied: numpy>=1.19.0 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from si
gnal-ict-keshvi-92510133028==1.0.0) (2.3.1)
Requirement already satisfied: matplotlib>=3.3.0 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (fro
m signal-ict-keshvi-92510133028==1.0.0) (3.10.6)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from
matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (1.3.3)
Requirement already satisfied: cycler>=0.10 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from ma
plotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (fro
m matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (4.59.2)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (fro
m matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (1.4.9)
Requirement already satisfied: packaging>=20.0 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from
matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (25.0)
Requirement already satisfied: pillow>=8 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from matplo
tlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (11.1.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from
matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (3.2.3)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (
from matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in c:\users\keshv\appdata\local\programs\python\python313\lib\site-packages (from python-
dateutil>=2.7->matplotlib>=3.3.0->signal-ict-keshvi-92510133028==1.0.0) (1.17.0)
signal-ict-keshvi-92510133028 is already installed with the same version as the provided wheel. Use --force-reinstall to force an
installation of the wheel.
PS E:\PWP\signal_ict_keshvi_92510133028> █
```