14. In the Jupyter ecosystem, what is the specific role of the "IPython Kernel"?
   a. It provides the web-based user interface for input and output.
   b. It handles the message protocol communication layer (ZMQ).
   c. It renders Markdown text and LaTeX equations.
   d. It executes the Python code and returns the results.

15. Which SciPy module is specifically designated for function optimizers (minimizers) and root-finding algorithms?
   a. `scipy.integrate`
   b. `scipy.optimize`
   c. `scipy.linalg`
   d. `scipy.special`

16. What is the primary difference between a tuple and a list in Python?
   a. Tuples are created using square brackets [], while lists use parentheses ().
   b. Tuples are immutable (cannot be changed after assignment), while lists are mutable (can be modified in place).
   c. Tuples can only contain integers, while lists can contain any data type.
   d. Lists are fixed-length, while tuples are variable-length.

17. Why does the expression `hash((1, 2, [3, 4]))` raise a `TypeError` in Python?
   a. Because tuples cannot be hashed.
   b. Because the tuple contains a mutable object (a list), making the tuple un-hashable.
   c. Because the hash function only accepts strings.
   d. Because the tuple is too short to be hashed.

18. What will be the output of the following Python code snippet?

```
my_list = ['a', 'b']
my_list.append(['c', 'd'])
my_list.extend(['e', 'f'])
print(my_list[-3])
```

   a. `'c'`
   b. `'e'`
   c. `['c', 'd']`
   d. `'d'`

19. What is the final state of the variable data after the following code executes?

```
data = (10, 20, [30, 40])
try:
    data[2].append(50)
    data[2] = [30, 40, 50]
except TypeError:
    pass
print(data)
```

   a. `(10, 20, [30, 40])`
   b. `(10, 20, [30, 40, 50])`
   c. `(10, 20, [30])`
   d. The code causes a crash and does not print.

27. Consider the following code. What is the key distinction between `arr_slice` and a standard Python list slice?

```
arr = np.arange(10)
arr_slice = arr[5:8]
arr_slice[1] = 12345
```

a. `arr_slice` is a separate copy; modifying it does NOT affect `arr`.
b. `arr_slice` is a view; modifying it updates the original `arr`.
c. `arr_slice` is read-only and throws an error.
d. `arr_slice` converts the data to floats automatically.

28. **What happens when you call the `.astype()` method on an array, such as `arr.astype(np.float64)`?**
a. It changes the data type of the existing array in place.
b. It creates a new array (a copy) with the specified data type.
c. It only changes the metadata without touching the data.
d. It converts the array to a Python list.

29. **What is the standard convention for importing NumPy in Python scripts?**
a. `import numpy`
b. `from numpy import *`
c. `import numpy as np`
d. `import np`

30. **Which function should you use if you want to create a linear sequence of numbers, similar to Python's built-in range but returning an array?**
a. `np.array_range`
b. `np.sequence`
c. `np.arange`
d. `np.list`

Part 2: Algorithm Workbench. 40 points in total.

Question 1 (10 Points): Write a Python program that prompts the user to input their age and subsequently indicates whether the individual is classified as a child (age < 12), a teenager (age < 18), an adult (age < 50), or a senior citizen (age >= 50).

```
n = int (input ("Enter your age"))
if n <12
Print
Output("you are a child")
if n <18
print ("you are a teenager")
if n<50
print("you are an adult")
if n >50
print(" you are a senior citizen
```

PART 1: 30 Multiple Choices Questions (MCQs) – 2 Points per Question – 30 Points in Total

1. **Variables in Python:**
   a. Are not declared. The data type of a variable is determined by the value it holds
   b. Are declared like C++ and Java
   c. Must be numerical
   d. None of the above

2. **What is the primary mechanism Python uses to enforce code blocks and scoping (like loops and functions)?**
   a. Semicolons (';')
   b. Indentation (Whitespace)
   c. Curly braces ('{}')
   d. Keywords ('begin' and 'end')

3. **Which loop structure in Python is designed to iterate over the elements of a sequence (like a list or tuple)?**
   a. do-while loop
   b. while loop
   c. until loop
   d. for loop

4. **What is the output of the following code?**

```
X = 20.56
X = "Welcome Python"
print(X)
```

   a. 20.56
   b. Reports an error
   c. Welcome Python
   d. 20.56 Welcome Python

5. **What is the output of the following code?**

```
product = 1
for i in range(5):
product *= i
print(product)
```

   a. 0
   b. 120
   c. Reports an error
   d. 13

6. **What is the output of the following code?**

```
S = 0
while S :
      print("Hello")
else:
      print("Bye")
```

   a. Hello
   b. Bye
   c. Reports an error
   d. 0

Q2- Input numpy as np

sales_data = np.array

Question 2 (30 Points): You are a data analyst for a small retail store. You have the sales data for **4 different products** sold over **5 days** (Monday to Friday). You need to process this data to generate a weekly report.

Task:

Write a Python script using the **NumPy** library to perform the following operations. You must use NumPy functions and vectorized operations where possible (avoid using for loops).

1. **Initialize Data:** Create a 2D NumPy array named sales_data representing the following sales figures (rows represent Products A, B, C, D; columns represent Mon-Fri):
   - Product A: 10, 15, 20, 25, 30
   - Product B: 50, 45, 60, 55, 65
   - Product C: 12, 12, 12, 10, 10
   - Product D: 100, 90, 80, 110, 120
2. **Apply Tax:** The prices listed above are exclusive of tax. Create a new array named total_sales by adding a flat tax of $5 to every single sales figure in the original array.
3. **Daily Revenue:** Calculate the **total revenue generated each day** (sum of all products for each column) and print the resulting array.
4. **Product Performance:** Calculate the **average sales figure** for each product (average of each row) and print the result.
5. **Identify High Sales:** Find and print the **number of days** where any single product sold more than **$100** (using the total_sales array).

werese-sales= total_sales

high_sales_days = np.a... array (total_sal... axis=0

Print(...)

7. Which of the following statements is not true with the functions?
   a. Function body should contain at least one return statement
   b. Functions can return multiple values
   c. Function body cannot be empty
   d. Functions can have multiple parameters

8. What type of object is returned by the following function?

```
def test_fun(a, b):
    return a+b, a*b
test_fun(10,20)
```

   a. Two integer values
   b. List
   c. Tuple containing the two results: (30, 200)
   d. Set

9. What is the output of the following code?

```
def rec_fun(n):
    if n<=5:
        return
    else :
        return n * (n-1)
print(rec_fun(4))
```

   a. None
   b. 24
   c. Get into infinite loop
   d. Error is generated

10. Which of the following is false?
   a. String objects are mutable
   b. An empty string can be created using str()
   c. Multiline strings are created using triple quotes
   d. A backslash is used as an escape sequence for strings

11. Which Python library is described as the "cornerstone of numerical computing" and serves as an efficient container for data to be passed between algorithms?
   a. Pandas
   b. NumPy
   c. Statsmodels
   d. SciPy

12. What is the primary distinction between `statsmodels` and `scikit-learn` as described in the text?
   a. `statsmodels` is for deep learning, while `scikit-learn` is for linear algebra.
   b. `statsmodels` focuses on prediction, while `scikit-learn` focuses on data visualization.
   c. `statsmodels` focuses on statistical inference and uncertainty estimates, while `scikit-learn` is more prediction-focused.
   d. `statsmodels` is a legacy library, while `scikit-learn` is the modern replacement for all statistical tasks.

13. Which object in the pandas library is explicitly described as a "tabular, column-oriented data structure with both row and column labels"?
   a. Series
   b. ndarray
   c. DataFrame
   d. SparseMatrix

20. Which keyword is used to check if a specific value exists within a list or dictionary?
a. `find`
b. `exists`
c. `has`
d. `in`

21. What is the primary data structure provided by the NumPy library?
a. A dictionary-based frame
b. A linked list
c. The `ndarray` (multidimensional array)
d. The binary tree

22. Why are NumPy algorithms generally significantly faster than their pure Python counterparts?
a. NumPy runs on the GPU by default.
b. NumPy uses C-based algorithms that operate on contiguous memory blocks, avoiding type-checking overhead.
c. NumPy automatically deletes data to save memory.
d. NumPy uses Python lists under the hood but compresses them.

23. Which of the following statements is TRUE regarding the data types within a single NumPy ndarray?
a. An array can contain a mix of integers, strings, and dictionaries at the same time.
b. The ndarray is a generic container for homogeneous data; all elements must be the same type.
c. Data types are only assigned when the array is saved to a file.
d. NumPy arrays always store data as strings by default.

24. Which attribute of a NumPy array object returns a tuple indicating the size of each dimension?
a. `arr.size`
b. `arr.dtype`
c. `arr.shape`
d. `arr.ndim`

25. What is the expected behavior of the function `np.empty((2, 2))`?
a. It returns an array filled with exact zeros.
b. It returns an array filled with ones.
c. It returns an array with uninitialized memory, potentially containing "garbage" values.
d. It raises a `ValueError` because no data was provided.

26. Analyze the following code snippet. What is the final state of `arr`?

```
arr = np.array([0, 1, 2, 3, 4, 5])
arr[2:4] = 12
```

a. `[0, 1, 12, 3, 4, 5]`
b. `[0, 1, 12, 12, 4, 5]`
c. `[0, 1, 2, 12, 12, 5]`
d. `[0, 1, 12, 12, 12, 5]`