CS 302/352: Computer graphics

Lab Assignment #3

Tutorial Based Assignment

Objective Questions

1. What will be the output of the following code?

```
import numpy as np
a = np.array([1, 2, 3])
b = np.array([4, 5, 6])
print(a + b)
```

A) [5, 7, 9]
B) Type Error
C) [1, 2, 3, 4, 5, 6]
D) Syntax Error

2. How do you create a 3×3 identity matrix in NumPy?

A) np.identity(3)
B) np.eye(3)
C) np.ones((3,3))
D) Both A and B

3. Which NumPy function is used to compute the element-wise square root of an array?

A) np.sqrt().
B) np.power().
C) np.log().
D) np.square().

4. What is broadcasting in NumPy?

A) Adding two arrays of different shapes automatically
B) A way to reshape arrays
C) A function for matrix multiplication
D) A NumPy method for generating random numbers

5. What is the output of the following code?

```
a = np.array([[1,2], [3,4]])
print(np.sum(a, axis=0))
```

A) Computes the sum of each column
B) Computes the sum of each row
C) Computes the total sum
D) Raises an error

Coding Problems

1. Array Creation and Indexing

- Create a 4×4 matrix with random numbers.
  Replace the first column with all ones.
  Print the modified matrix.

2. Matrix Operations

- Create two 3×3 matrices with random integers.
  Perform element-wise addition, subtraction, multiplication, and division.
  Print the determinant of both matrices.

3. Broadcasting in NumPy

- Create a 3×3 matrix and a 1D array of size 3.
  Use broadcasting to add the 1D array to each row of the matrix.
  Print the result.

4. Midpoint Theorem

- Given two points A(x1, y1) and B(x2, y2), calculate the midpoint M(x, y) using the midpoint theorem:

  $M_x = (x1 + x2)/2$, $M_y = (y1 + y2)/2$

  Write a Python function to compute and print the midpoint of two given points.

5. Plotting with Matplotlib

- Plot the functions y = sin(x) and y = cos(x) for x ranging from 0 to 2π.
  Use different colours and markers for both curves.
  Add labels, a title, and a legend.

6. Implement Bresenham's Line Drawing Algorithm in Python.

Your function should:

- Take two endpoints (x1,y1) and (x2,y2) as input.
  Compute and return all the integer coordinate points that form the line between the two points.
  Plot the generated points using Matplotlib.

Instructions

- Include comments in your code explaining each step.
- You can use Python or MATLAB for the coding questions.
- Ensure your code handles edge cases (e.g., empty lists or sets).
- Submit your answers in a pdf file with format: assignment3_<roll. no.>.pdf.