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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
THIRD YEAR, SECOND SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE

KCS 311 – SCIENTIFIC COMPUTING

Date: 8th December, 2022
Time: 11:30am – 1:30pm

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Explain step by step what happens during the following instructions:

```
sage: u = SR.var('u')
sage: u = u+1
sage: u = u+1
sage: u
u + 2
```

(5 Marks)

b) Answer the following questions as per sageMath console.

i) What is sageMath? (2 Marks)

ii) Correct the error in the formula. 2mark

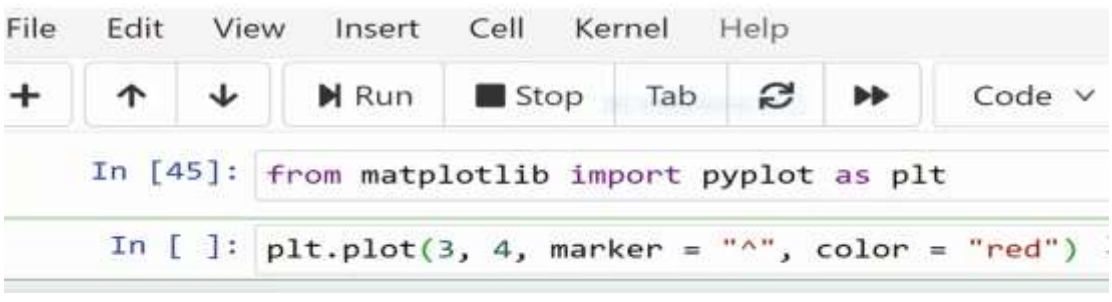
```
1 17(68+72)

1
--------
TypeError                                 Trac
ll last)
<ipython-input-15-85a4e1c5a046> in <module>()
----> 1 Integer(17)(Integer(68)+Integer(72))
```

iii) What is the function of key shift +enter? (2 Marks)

iv) Express the output in the numerical approximation argument (5/6., digits = 3) (3 Marks)

v) What does the following import library perform? Implement it on sage. (4 Marks)



vi) Why are numerical methods applied in high speed computation? (4 Marks)

vii) Find the $(----)_{10}$ corresponding to the $(111.011)_2$. (5 Marks)

viii) Write the correct output result in storing data in variables.

Diameter=3
Cicurmference=pi*diameter
Print (n(circumference. digit =3))
=9.42777960 (5 Marks)

QUESTION TWO (20 MARKS)

a) Solve the differential equation dy/dx+y(x)-2=0. (6 Marks)

b) Solve the following system of linear equation using sagemath commands on sage console.

a) 2x1+3x2-4x3=-7
-x1+2x2-x3=1
x1+2x2+3x3=7 (7 Marks)

b) $4x_1+x_2+2x_3 = 9$

$2x_1+4x_2- x_3 = -5$

$x_1+ x_2- 3x_3 = -9$ (7 Marks)

QUESTION THREE (20 MARKS)

Solve the differential equation $\frac{dy}{dx} = \frac{xy^2-\cos(x)\sin(x)}{(y(1-x^2)}$ with $y(0) = 2$.

a)

using sage math commands.show all your working.

(10 Marks)

b)

Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$, $y(0) = 3, y(\pi/2) = 2$ in Sage.

(10 Marks)

QUESTION FOUR (20 MARKS)

a) Solve the following linear equations using Gaussian elimination method show all steps.

$6x_1-2x_2+2x_3+4x_4 = 16$

$12x_1-8x_2+6x_3+10x_4 = 26$

$3x_1-13x_2+9x_3+3x_4 = -19$

$-6x_1+4x_2+x_318x_4 = -34$ (10 Marks)

b) Compute the absolute and relative error in approximation of p by p* @4mrk

i) p=π p*=22/7

ii) p=8! p*=39900

iii) p=e p*=2.718 (10 Marks)

QUESTION FIVE (20 MARKS)

a) Solve the below system using the Jordan Canonical Form. 8marks

Example 5. Consider a system of linear equations $X' = AX$ where $A = \begin{pmatrix} 2 & 1 & 1 \\ 2 & 1 & -2 \\ -1 & 0 & 2 \end{pmatrix}$ and $X(0) = \begin{pmatrix} 8 \\ 32 \\ 5 \end{pmatrix}$

(8 Marks)

b) Define the coefficient matrix A and calculate its JCF.

(6 Marks)

c) Verify that $P^{-1}AP = J$. (6 Marks)