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College Sangamner

DEPARTMENT OF COMPUTER SCIENCE

Sub : Mathematics

Remark
Demonstrator's
Signature
Date:- / /20

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Title of the expt:-__Slip no 3_____Page.no:-_____Class:-BCS_____

Q1.Attemp any one of the following

a) Using Python plot the graph of function f(x)=cos(x) on the interval [0,2π]

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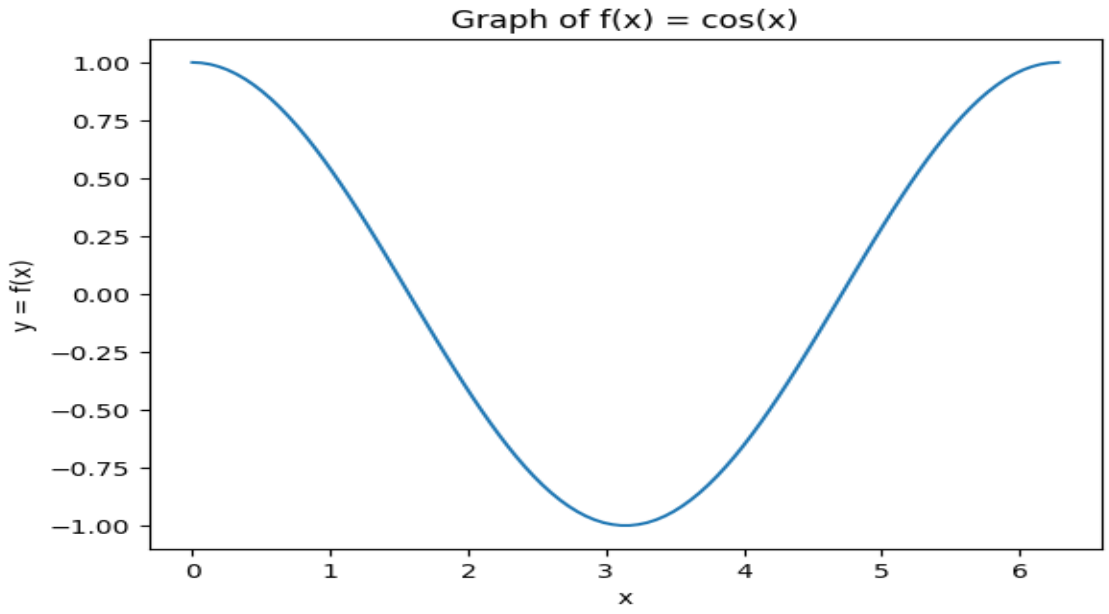
```
import numpy as np
import matplotlib.pyplot as plt

def f(x):
   return np.cos(x)

x = np.linspace(0, 2*np.pi, 100)
y = f(x)
plt.plot(x, y)
plt.title("Graph of f(x) = cos(x)")
plt.xlabel("x")
plt.ylabel("y = f(x)")
plt.show()
```

output :



b) Following is the information of students participating in varios games in a school,Represnet it by Bar graph with bar Width of 0.7 inches

Game	Cricket	Football	Hockey	Chess	Tennis
Number of student	65	30	54	10	20

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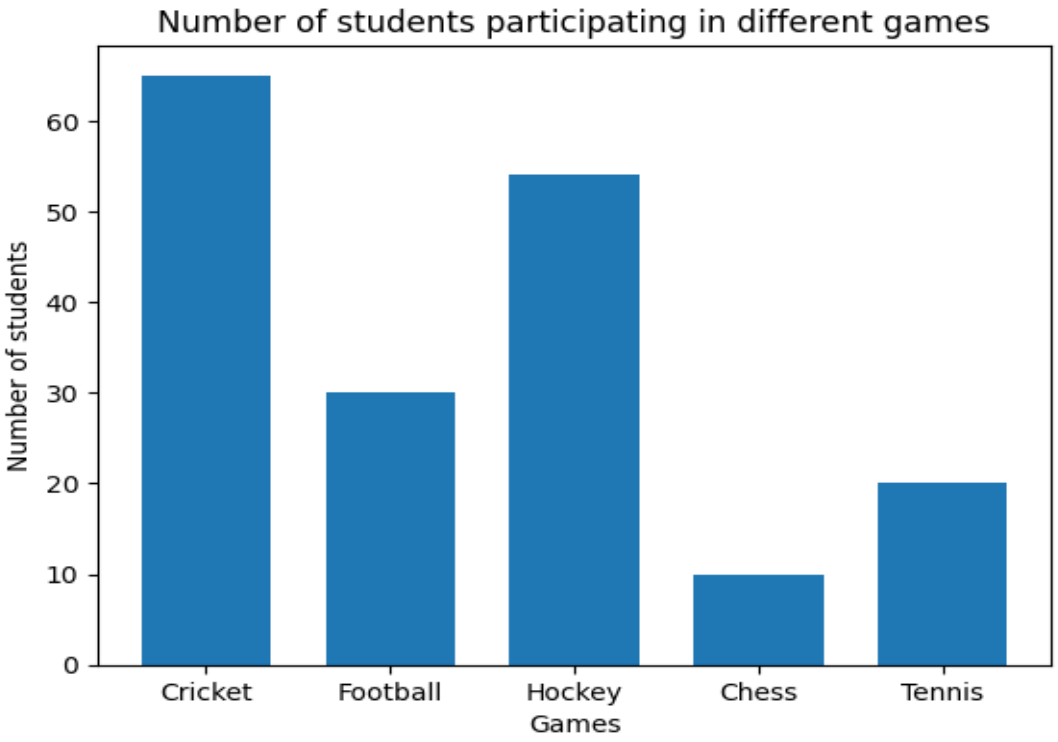
```
import matplotlib.pyplot as plt
games = ['Cricket', 'Football', 'Hockey', 'Chess', 'Tennis']
students = [65, 30, 54, 10, 20]
width = 0.7
plt.bar(games, students, width)
plt.title('Number of students participating in different games')
plt.xlabel('Games')
plt.ylabel('Number of students')
plt.show()
```

output:



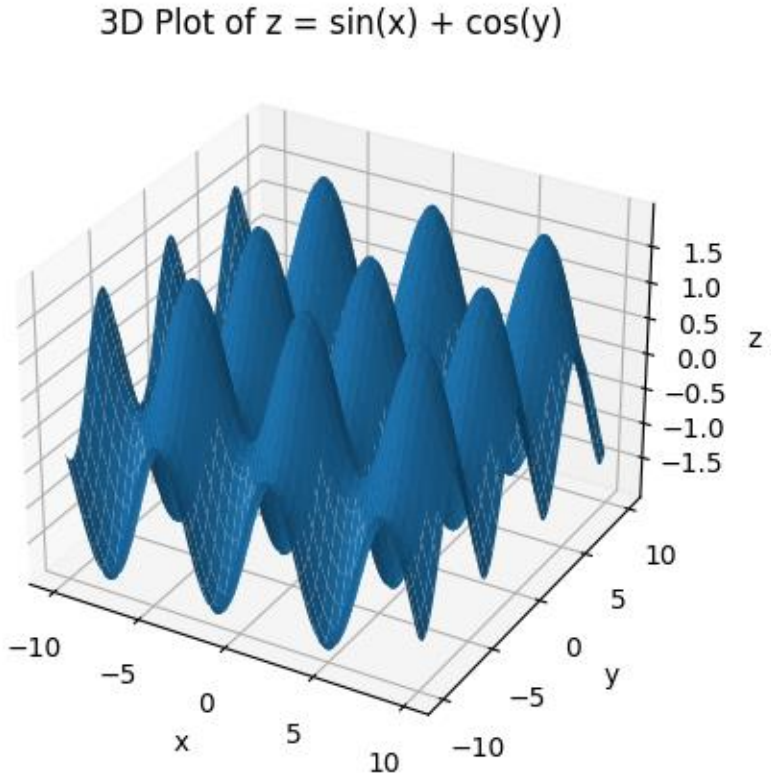
C) Write a Python Program to generate 3D plot of the function z=sin x +cos y in -10<x,y<10.

->

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
def f(x, y):
    return np.sin(x) + np.cos(y)

x = np.arange(-10, 10, 0.1)
y = np.arange(-10, 10, 0.1)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X, Y, Z)
ax.set_title('3D Plot of z = sin(x) + cos(y)')
ax.set_xlabel('x')
ax.set_ylabel('y')
ax.set_zlabel('z')
plt.show()
```

output :



Q2) Attempt any TWO of the following

a) **Write a python program to reflect the line segment joining the points A[5,3] & B[1,4] through the line y=x+1**

-→

```
import numpy as np
A = np.array([5, 3])
B = np.array([1, 4])
m = 1
b = 1
midpoint = (A + B) / 2
slope = -1 / m
y_intercept = midpoint[1] - slope * midpoint[0]

x_intersect = (b - y_intercept) / (slope - m)
y_intersect = slope * x_intersect + y_intercept
P = np.array([x_intersect, y_intersect])
A_reflected = 2 * P - A
B_reflected = 2 * P - B
print("The reflection of A through the line y=x+1 is:", A_reflected)
print("The reflection of B through the line y=x+1 is:", B_reflected)
```

output :

```
The reflection of A through the line y=x+1 is: [0.5 4.5]
The reflection of B through the line y=x+1 is: [4.5 3.5]
```

b) If the points A[2,1],B[4,-1] is transformed by the transformation matrix [T]=$\begin{matrix}1 & 2\\ 2 & 1\end{matrix}$, then Using python ,find the euquation of transformation line

→

```
import numpy as np
A = np.array([2, 1])
B = np.array([4, -1])
T = np.array([[1, 2], [2, 1]])
A_transformed = np.dot(T, A)
B_transformed = np.dot(T, B)
m = (B_transformed[1] - A_transformed[1]) / (B_transformed[0] - A_transformed[0])
b = A_transformed[1] - m * A_transformed[0]
transformation_line = f"y = {m}x + {b}"
print("Equation of transformation line:", transformation_line)
```

output :

```
Equation of transformation line: y = -1.0x + 9.0
```

C) Generate line segment having endpoint (0,0) and (10,10) find midpoint of line segment.

-→

```
import numpy as np
A = np.array([0, 0])
B = np.array([10, 10])
midpoint = (A + B) / 2
print("Midpoint of the line segment:", midpoint)
```

output :

```
Midpoint of the line segment: [5. 5.]
```

Q3) Attempt any of the following

a) Attempt any one of the following

i)Write A python program to solve the following LPP

Min Z=3.5x+2y

Subject x+y≥5

x≥5

y≤2

x,y≥0

-→

```
import numpy as np
from scipy.optimize import linprog
c = np.array([3.5, 2])
A = np.array([[-1, -1],
              [-1, 0],
              [0, 1]])
b = np.array([-5, -5, 2])
x_bounds = (0, None)
y_bounds = (0, None)
result = linprog(c=c, A_ub=A, b_ub=b, bounds=[x_bounds, y_bounds])
print("Optimal solution:", result.x)
print("Optimal value:", result.fun)
```

output :

```
Optimal solution: [5. 0.]
Optimal value: 17.5
```

Ii)Write a python program to display the following LPP by using pulp module and simplex method.Find optimal solution if exist

Max $z=3x_1+5x_2+4x_3$

Subject to $2x_1+3x_2 \leq 8$

$2x_2+5x_3 \leq 10$

$3x_1+2x_2+4x_3 \leq 15$

$x_1, x_2, x_3 \geq 0$

-→

```
import pulp as lp
prob = lp.LpProblem("LP problem", lp.LpMaximize)
x1 = lp.LpVariable("x1", lowBound=0)
x2 = lp.LpVariable("x2", lowBound=0)
x3 = lp.LpVariable("x3", lowBound=0)

prob += 3*x1 + 5*x2 + 4*x3
prob += 2*x1 + 3*x2 <= 8
prob += 2*x2 + 5*x3 <= 10
prob += 3*x1 + 2*x2 + 4*x3 <=15
prob.solve(lp.solvers.PULP_CBC_CMD(msg=0))
print("Optimal solution:")
print("x1 =", lp.value(x1))
print("x2 =", lp.value(x2))
print("x3 =", lp.value(x3))
print("Optimal value: z =", lp.value(prob.objective))
```

b) Attempt any ONE of the Following

I) Apply Python program in each of the following transformation on the point P[4,-2]

i) **Reflection through the Y-axis**
ii) **Scaling in X-cordinate by Factor 3**
iii) **Scaling in Y-cordinate by factor 2.5**
iv) **Reflection through the line y=-x**

-→

```
P = [4, -2]
P_reflect_y = [-P[0], P[1]]
print("Reflection through the Y-axis:", P_reflect_y)
P_scale_x = [3*P[0], P[1]]
print("Scaling in X-coordinate by Factor 3:", P_scale_x)
P_scale_y = [P[0], 2.5*P[1]]
print("Scaling in Y-coordinate by Factor 2.5:", P_scale_y)

P_reflect_line = [-P[1], -P[0]]
print("Reflection through the line y=-x:", P_reflect_line)
```

output :

Reflection through the Y-axis: [-4, -2]
Scaling in X-coordinate by Factor 3: [12, -2]
Scaling in Y-coordinate by Factor 2.5: [4, -5.0]
Reflection through the line y=-x: [2, -4]

II) Find the combined transformation of the line segment between the points A[2,-1] & B[5,4] by using Python program for the following sequence of transformation

I) Rotation about origin through an angel π
Ii) Scaling in X-cordinate by 3 unit
III) Shearing in X direction by 6 units
IV) Reflection through the line y=x

→

```
import numpy as np

AB = np.array([[2, -1], [5, 4]])

theta = np.pi

R = np.array([[np.cos(theta), -np.sin(theta)], [np.sin(theta), np.cos(theta)]])

AB_rotated = np.matmul(R, AB.T).T

print("After rotation about origin through an angle pi:", AB_rotated)

S_x = np.array([[3, 0], [0, 1]])

AB_scaled_x = np.matmul(S_x, AB.T).T

print("After scaling in X-coordinate by 3 units:", AB_scaled_x)

Sh_x = np.array([[1, 6], [0, 1]])

AB_sheared_x = np.matmul(Sh_x, AB.T).T

print("After shearing in X-direction by 6 units:", AB_sheared_x)

R_yx = np.array([[0, 1], [1, 0]])

AB_reflected_yx = np.matmul(R_yx, AB.T).T

print("After reflection through the line y=x:", AB_reflected_yx)

AB_transformed = np.matmul(R_yx, np.matmul(Sh_x, np.matmul(S_x, np.matmul(R,
AB.T)))).T

print("After combining all transformations:", AB_transformed)
```