### COMPUTER PROGRAMMING I

## **KEYS TO MIDTERM EXAM**

This is a 90-Minute Exam

Q.1)	Q.2)	Q.3)	Q.4)

Q.1) (20) Write a function to calculate the area of a triangle with side lengths a, b, and c. The area can be computed using the Heron's formula:  $Area = \sqrt{s \times (s-a) \times (s-b) \times (s-c)}$  where  $s = \frac{1}{2}(a+b+c)$ . For a, b, and c to form a triangle, two conditions must be satisfied. First, all side lengths must be positive: a > 0, b > 0, c > 0. Second, the sum of any two side lengths must be greater than the third side length: a + b > c, b + c > a, or a + c > b.

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# Q.2) (45) A quadratic equation of the form

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

with the product  $ABC \neq 0$  corresponds to a conic section (parabola, ellipse, circle, or hyperbola). The type of conic section is determined by the values of the *characteristic* and the *discriminant*. The discriminant is the value  $B^2 - 4AC$ , and the characteristic is

$$\begin{vmatrix} A & B/2 & D/2 \\ B/2 & C & E/2 \\ D/2 & E/2 & F \end{vmatrix} = A \begin{vmatrix} C & E/2 \\ E/2 & F \end{vmatrix} - \frac{B}{2} \begin{vmatrix} B/2 & E/2 \\ D/2 & F \end{vmatrix} + \frac{D}{2} \begin{vmatrix} B/2 & C \\ D/2 & E/2 \end{vmatrix}$$
 where 
$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$
.

The resulting conic sections are classified as follows:

Discriminant	Characteristic	Type of Conic Section	
0	≠0	Nondegenerate Parabola	
0	0	Degenerate Parabola	
<0	≠0	Nondegenerate ellipse or circle	
<0	0	Degenerate Ellipse	
>0	≠0	Nondegenerate Hyperbola	
>0	0	Degenerate Hyperbola	

```
def get discriminant(a,b,c):
 return b*b-4*a*c
def get determinant(a,b,c,d):
 return a*d-b*c
def get characteristic(A,B,C,D,E,F):
 return A * get determinant(C, E / 2, E / 2, F)
     - (B/2) * get determinant(B / 2, E / 2, D / 2, F)
     + (D/2) * get determinant (B / 2, C, D / 2, E / 2)
def get type of conic(A,B,C,D,E,F):
 discriminant = get discriminant(A,B,C)
 characteritic = get characteristic(A,B,C,D,E,F)
 if discriminant == 0 and characteristic != 0:
    return "Nondegenerate Parabola"
 elif discriminant == 0 and characteristic == 0:
   return "Degenerate Parabola"
 elif discriminant < 0 and characteristic != 0:</pre>
    return "Nondegenerate ellipse or circle"
 elif discriminant < 0 and characteristic == 0:</pre>
    return "Degenerate Ellipse"
 elif discriminant > 0 and characteristic != 0:
    return "Nondegenerate Hyperbola"
 elif discriminant > 0 and characteristic == 0:
    return "Degenerate Hyperbola"
```

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Q.3) (15) What is the output of the following script? Write your answer inside the boxes.

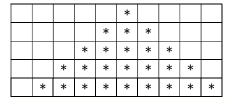
```
def fun(t):
    a, b, c = t
    if a <= b <= c:
        return b
    elif b <= a <= c:
        return a
    else:
        return c

for u in [(7,2,4), (22,15,33), (14,15,16)]:
    print(f"fun({u}): {fun(u)}")

    fun((7, 2, 4)): 4
    fun((22, 15, 33)): 22
    fun((14, 15, 16)): 15</pre>
```

Q.4) (20) What is the output of the following script? Write your answer inside the boxes.

```
for i in range(0,5):
  for j in range(0,10):
    if 5-i <= j <= 5+i:
        print("*",end="")
    else:
        print(" ",end="")
    print()</pre>
```



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