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Batch - A

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CG Tutorial - 3

Midpoint Circle Algorithm

E)

1. $R = 15$; Centre = $(1,1)$

$(x_1, y_1) = (1,1)$

$(x_0, y_0) = (0, r) = (0, 15)$

$\because$ r is an integer

$\therefore P_0 = 1 - r = 1 - 15 = -14$

$\because P_0 < 0$

(i) $\therefore (x_1, y_1) = (x_k + 1, y_k) = (0+1, 15) = (1, 15)$

$P_1 = P_0 + 2x_{k+1} + 1$ where $2x_{k+1} = 2x_k + 2$

$= -14 + 2(0) + 2 + 1$

$= -14 + 3 = -11$

(ii) $P_1 < 0$

$(x_2, y_2) = (1+1, 15) = (2, 15)$

$P_2 = -11 + 2(1) + 2 + 1 = -6$

(iii) $P_2 < 0$

$(x_3, y_3) = (2+1, 15) = (3, 15)$

$P_3 = -6 + 2(2) + 2 + 1 = 1$

(iv) $P_3 > 0$

$(x_4, y_4) = (x_3 + 1, y_3 - 1) = (3+1, 15-1) = (4, 14)$

$P_4 = P_3 + 2x_{k+1} + 2 - 2y_{k+1} + 2$

$= 1 + 2(3) + 2 - 2 - 2(15) + 2$

$= -18$

(v) $P_4 < 0$

$(x_5, y_5) = (4+1, 14) = (5, 14)$

$P_5 = -18 + 2(4) + 2$

$= -18 + 10 = -8$

(vi) $P_5 < 0$

$(x_6, y_6) = (5+1, 14) = (6, 14)$

$P_6 = -7 + 10 + 3 = 6$

(viii) $P_6 > 0$

$(x_7, y_7) = (6+1, 14-1) = (7, 13)$

$P_7 = 6 + 2(6) + 3 - 2(14) + 2 = -5$

(viii) $P_7 < 0$

$(x_8, y_8) = (8, 13)$

$P_8 = -5 + 2(7) + 3 = -5 + 13 = 12.$

(ix) $P_8 > 0$

$(x_9, y_9) = (9, 12)$

$P_9 = 12 + 2(8) + 3 - 2(13) + 2$

$= 1$

(x) $P_9 > 0$

$(x_{10}, y_{10}) = (10, 11)$

$P_{10} = 7 + 2(9) + 3 - 2(12) + 2 = 6$

(xi) $P_{10} > 0$

$(x_{11}, y_{11}) = (11, 10)$

$x \geq y$ is satisfied.

$x = x + x_c, \quad y = y + y_c$

$x_c, y_c = 1, 1$

∴ points of first quadrant of the circle are:

(x, y) : $(0, 15)$, $(1, 15)$, $(2, 15)$, $(3, 15)$, $(4, 14)$, $(5, 14)$, $(6, 14)$, $(7, 13)$, $(8, 13)$, $(9, 12)$, $(10, 11)$, $(11, 10)$

2. $r = 10$ center $= (2, 2)$

$(x_0, y_0) = (0, r) = (0, 10)$

$P_0 = 1 - r = 1 - 10 = -9$

(i) $P_0 < 0$

$(x_1, y_1) = (1, 10)$

$P_1 = P_0 + 2(0) + 2 + 1$

$= -6$

(ii) $P_1 < 0$

$(x_2, y_2) = (1+1, 10) = (2, 10)$

$P_2 = -6 + 2(1) + 2 + 1 = -1$

(iii) $P_2 < 0$

$(x_3, y_3) = (3, 10)$

$P_3 = -1 + 2(2) + 2 + 1 = 6$

(iv) $P_3 \geq 0$

$(x_4, y_4) = (4, 9)$

$P_4 = 6 + 8 + 1 - 18 = -3$

(v) $P_4 < 0$

$(x_5, y_5) = (5, 9)$

$P_5 = -3 + 2(4) + 2 + 1 = -3 + 11 = 8$

(vi) $P_5 > 0$

$(x_6, y_6) = (6, 8)$

$P_6 = 8 + 2(5) + 3 - 2(4) + 2 = 25$

(vii) $P_6 > 0$

$(x_7, y_7) = (7, 7)$

$\therefore x_7 \geq y_7$ is satisfied

$x = x + x_1 \; ; y = y - y_1$

$(x_1, y_1) = (2, 2)$

$\therefore$ Points of Circle in 1st Quad. are

(x, y) : $(2, 12), (3, 12), (4, 12), (6, 12), (6, 11), (7, 11), (8, 10), (9, 9)$.