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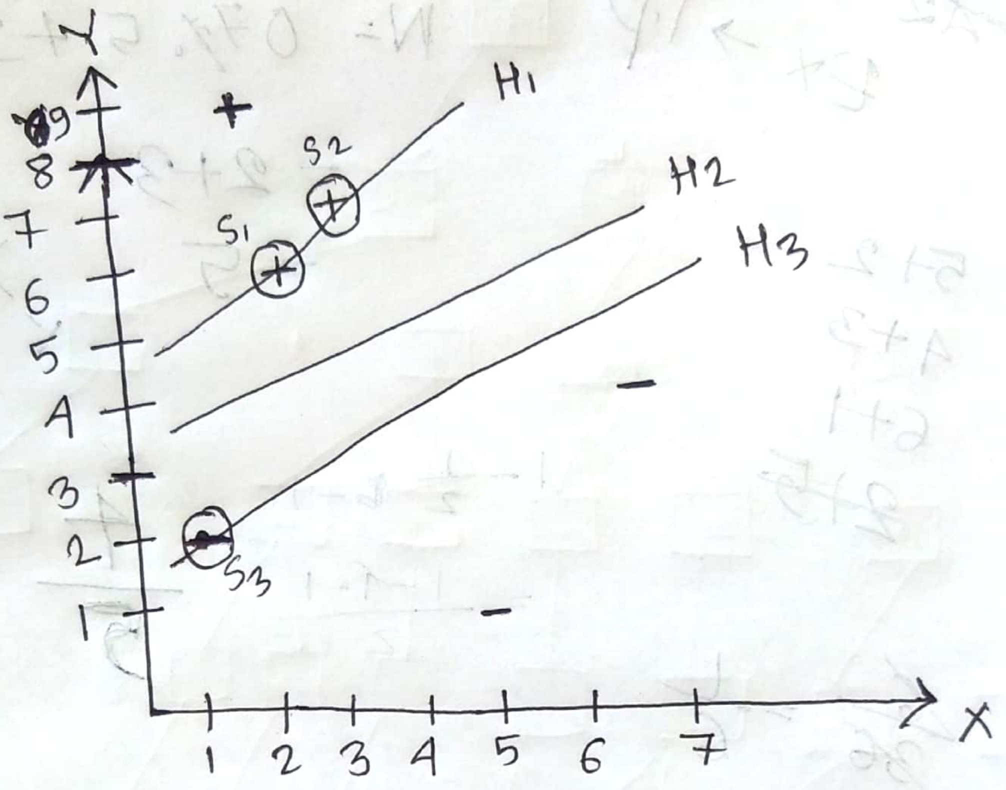
Answer to the question no: 1

a = 17101007 % 2 = 1
b = 17101007 % 3 = 2
c = 17101007 % 4 = 3
d = 17101007 % 5 = 2
e = 17101007 % 6 = 5
f = 17101007 % 7 = 0
g = 17101007 % 8 = 7

| Index | X coordinate | Y coordinate | Label |
|---|---|---|---|
| 1 | 1 | 2 | − |
| 2 | 2 | 6 | + |
| 3 | 3 | 7 | + |
| 4 | 2 | 9 | + |
| 5 | 5 | 1 | − |
| 6 | 0 | 3 | − |
| 7 | 7 | 4 | − |




$S_1, S_2, S_3$ are support vector points.

$H_1, H_2, H_3$ Hyperplane.

$H_2$ margin.

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Answer to the question no: 2

$a = 17101007 \% 3 = 2$

$b = 17101007 \% 5 = 2$

$c = 17101007 \% 7 = 0$

$F(x,y,z) = 2x + 2y + 0 = 2x+2y$

$g(x,y,z) = x^2+y^2+z^2-2$

Lagrance function,

$F(x,y,z,\lambda) = f(x,y,z) - \lambda * g(x,y,z)$

$F_x = 0$

$F_y = 0$

$F_z = 0$

$F_\lambda = 0$

$$F_x = \frac{\partial}{\partial x} F(x,y,z,\lambda)$$

$$= \frac{\partial}{\partial x}\{f(x,y,z) - \lambda * g(x,y,z)\}$$

$$= \frac{\partial}{\partial x}\{2x+2y-\lambda(x^2+y^2+z^2-2)\}$$

$$= \frac{\partial}{\partial x}\left\{2x+2y-\lambda x^2-\lambda y^2-\lambda z^2+2\lambda\right\}$$

$$= 2+0-2\lambda x+0+0+0$$

$$F_x = 2-2\lambda x$$

$$F_x = 0$$

$$2-2\lambda x = 0$$

$$2 = 2\lambda x$$

$$x = \frac{2}{2\lambda}$$

$$x = \frac{1}{\lambda}$$

$$F_y = \frac{\partial}{\partial y}\left\{F(x,y,z,\lambda)\right\}$$

$$= \frac{\partial}{\partial y}\left\{2x+2y-\lambda x^2-\lambda y^2-\lambda z^2+2\lambda\right\}$$

$$= 0+2-0-2\lambda y-0+0$$

$$F_y = 2-2\lambda y$$

$$F_y = 0$$

$$2-2\lambda y = 0$$

$$2 = 2\lambda y$$

$$y = \frac{2}{2\lambda}$$

$$\cancel{y = \frac{1}{\lambda}} \quad y = \frac{1}{\lambda}$$

$$F_z = \frac{\partial}{\partial z}\{F(x, y, z, \lambda)\}$$

$$= \frac{\partial}{\partial z}\{2x + 2y - \lambda x^2 - \lambda y^2 - \lambda z^2 + 2\lambda\}$$

$$= 0 + 0 - 0 - 0 - 2z\lambda + 0$$

$$F_z = -2z\lambda$$

$$0 = -2z\lambda$$

$$z = 0$$

$$F_\lambda = \frac{\partial}{\partial \lambda}\{2x + 2y - \lambda x^2 - \lambda y^2 - \lambda z^2 + 2\lambda\}$$

$$= 0 + 0 - x^2 - y^2 - z^2 + 2$$

$$F_\lambda = 2 - x^2 - y^2 - z^2$$

$$F_\lambda = 0$$

$$2-x^2-y^2-z^2=0$$

$$2=x^2+y^2+z^2$$

$$2=\left(\frac{1}{\lambda}\right)^2+\left(\frac{1}{\lambda}\right)^2+0$$

$$2=\frac{1}{\lambda^2}+\frac{1}{\lambda^2}$$

$$2=\frac{1+1}{\lambda^2}$$

$$2=\frac{2}{\lambda^2}$$

$$1=\frac{1}{\lambda^2}$$

$$\lambda^2=1$$

$$\lambda=\pm 1$$

$$\lambda=-1,1$$

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When,
$\lambda = -1$

$x = \frac{1}{\lambda} = \frac{1}{-1} = -1$

$y = \frac{1}{\lambda} = \frac{1}{-1} = -1$

$z = 0$

$\therefore (x, y, z) = (-1, -1, 0)$

When,
$\lambda = 1$

$x = \frac{1}{\lambda} = \frac{1}{1} = 1$

$y = \frac{1}{\lambda} = \frac{1}{1} = 1$

$z = 0$

$\therefore (x, y, z) = (1, 1, 0)$

(Ans)