Assignment 1

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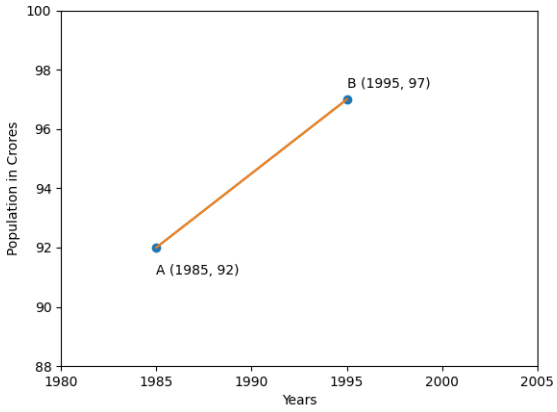
1) Consider the following population and year graph , Find the slope of the line AB and using it, find what will be the population in the year 2010?



Solution: Given the points $\mathbf{A}\begin{pmatrix}1985\\92\end{pmatrix}$, $\mathbf{B}\begin{pmatrix}1995\\97\end{pmatrix}$
The direction vector is given by,

$$\mathbf{m} = \mathbf{B} - \mathbf{A} \tag{0.0.1}$$

$$\mathbf{m} = \begin{pmatrix}1995\\97\end{pmatrix} - \begin{pmatrix}1985\\92\end{pmatrix} \tag{0.0.2}$$

$$\mathbf{m} = \begin{pmatrix}10\\5\end{pmatrix} \tag{0.0.3}$$

The slope of the line is $\frac{5}{10} = \frac{1}{2}$ The normal of the line $\mathbf{n}$ is given by,

$$\mathbf{n} = \begin{pmatrix}5\\-10\end{pmatrix} \tag{0.0.4}$$

Any point, $\mathbf{x}$ on the line can be written in the form

$$\mathbf{n}^T(\mathbf{x} - \mathbf{A}) = 0 \tag{0.0.5}$$

$$\mathbf{n}^T\mathbf{x} = \mathbf{n}^T\mathbf{A} = c \tag{0.0.6}$$

$$\mathbf{n}^T\mathbf{x} = c \tag{0.0.7}$$

Here the value of c is given by

$$c = \begin{pmatrix}5 & -10\end{pmatrix}\begin{pmatrix}1985\\92\end{pmatrix} \tag{0.0.8}$$

$$c = 5 * 1985 + (-10) * 92 \tag{0.0.9}$$

$$c = 9005 \tag{0.0.10}$$

We need to find the population in the year 2010

$$\mathbf{n}^T\mathbf{x} = c \tag{0.0.11}$$

$$\mathbf{x} = \begin{pmatrix}2010\\y\end{pmatrix} \tag{0.0.12}$$

$$\begin{pmatrix}5 & -10\end{pmatrix}\begin{pmatrix}2010\\y\end{pmatrix} = 9005 \tag{0.0.13}$$

$$5 * 2010 + (-10)y = 9005 \tag{0.0.14}$$

$$10y = 1045 \tag{0.0.15}$$

$$y = 104.5 \tag{0.0.16}$$

Hence the population in the year 2010 is 104.5 crores.