Data Analytics MCA-134
CIA test

1) B.

$f(x) = x^2 - 4x + 4$

learning rate = 0.2

compute of iteration with 3 decimal places

$f(x) = x^2 - 4x + 4$

$f'(x) = \frac{f(x)}{dx} = 2x - 4$

The condition for global minima for f(x) is

$f'(x) = 0$.

$2x - 4 = 0$

i.e = $2x = 4$.

$x = \frac{4}{\cancel{2}}{}^{2} = 2_1$

x	y
3	1
2	0
1	1
0	4
-1	9

$f(x) = \cancel{\text{bH}}$

$x^2 - 4x + 4$

$= (3)^2 - 4(3) + 4$

$9 - 12 + 4$

$9 - 8$

$= 1$

$0^2 - 4(0) + 4$

$(-1)^2 - 4(-1) + 4$

$1 + 4 + 4$

$2^2 - (4)(2) + 4$

$4 - 8 + 4$

0

$1^2 - 4(1) + 4 = 1 - 4 + 4 = 1$

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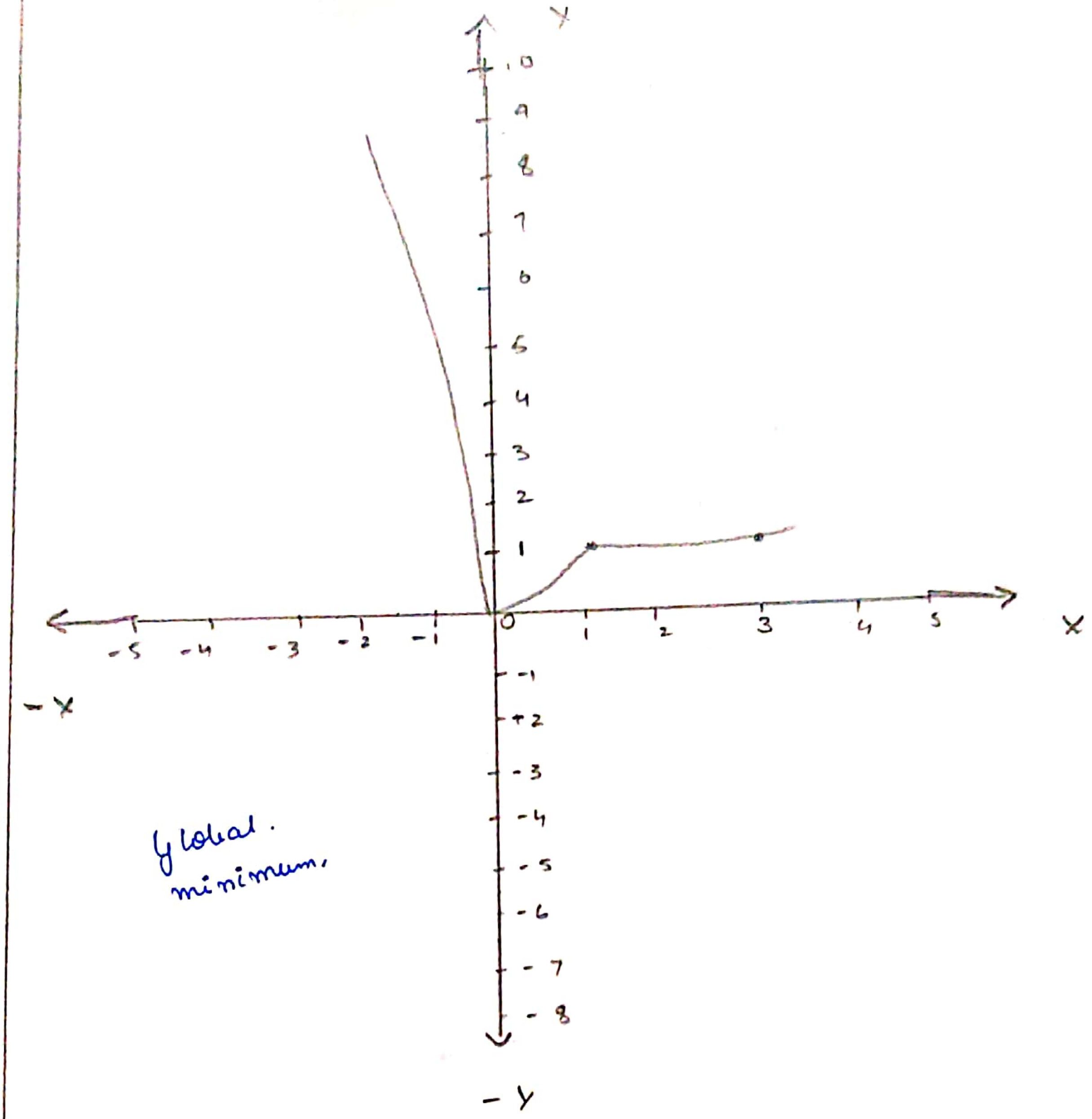

Gradiant decendd algoritham :

(1) Take a random point $x_0 = 2.5$

(2) Value of the slope at $f'(x_0)$ should. be completed

$$f(x)^2 = x^2 - 4x + 4$$

$$f'(x_0) = 2x - 4$$

$$f'(2.5) = 2(2.5) - 4$$

$$= 5 - 4$$

$$= 1$$

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(2)

so the $f'(x_0)$ value decides whether the initial given is incremented or decremented

lets put $x = -1$

$f'(x) = 2x - 4$

$= -2 - 4$

$= -6$

$\therefore$ By using this we can get to know that incrementation should happen for the inital value.

3. Moving in the opposite direction to the slope

Ex: If $x_0 = 2.5$

$f'(x)$ the slope is the.

we can say that the decrementation should happen for the guessed value

$x_{i+1} = x_i - \eta f'(x_i)$

$\eta = 0.2$

first iteration

$x_0 = 2.5$

$f'(2.5) = 2.4$

$x_1 = x_0 - \eta f'(2.5)$

$= 2.5 - 0.2(2.4)$

$= 2.02$

$f'(2.02) = 2x - 4$

$2(2.02) - 4$

$4.04 - 4$

0.04

$= 0$

second iteration

$x_2 = (x_1 - \eta f'(x_1))$

$2.02 - 0.2(0.04)$

$x_2 = 2.01 = 2$

$f'(x_2) = 2x - 4$

$= 2(2.01) - 4$

$= 0.02$

$= 0$

Third iteration

$$x_3 = x_2 - \alpha f'(x_2)$$

$$2 - 0.2\,(0.02)$$

$$1.9$$

$$f'(x_3) = 2x - 4$$

$$2(1.9) - 4$$

$$3.8 - 4$$

$$-0.24$$

x_0	2.5
x_1	2.02
x_2	2.01
x_3	1.9

$f'(x) = 0$ or near to zero.

$\therefore$ gradient descent is 1.9 at x_3 computation

3) Geospatial Data models :

A data model is a way of defining & representing real world surfaces and characteristics in GIS. There are two primary types of spatial data model : Vector & Raster

Vector - data representing features as discrete points, lines and polygon

Raster - data represents feature as a rectangular matrix of square cells

→ Vector model are points, lines & polygons.

Vector data is not made up of a grid of pixels. Instead, vector graphics are comprised of vertices & paths. The 3 basic symbols types for vector data are points, lines and polygons. Because cartographers use these symbols to represent real-world features in maps, they often have to decide based on the level of detail in the map.

Points are XY coordinates

Vector points are simply XY coordinates. Generally they are a latitude & longitude with a spatial reference frame. When features are too small to be represented as polygon, points are used for example you can't see city boundary lines on a global scale scale In this case maps often use points to display cities

Lines connect vertices - Vector lines connect each vertex with path basically connecting the dots in a set order and it becomes a vector line with each dot representing a vertex. Lines usually represent features that are linear in nature. For example maps show rivers, roads & pipelines as vector lines.

For example: It/can be if you were to find an optimal route using a traffic line network it would follow set rules [it can restrict turn & movement on one way street]

Polygons connect vertices & close the path.
When we join a set of vertices in a particular order & close it this is now a vector polygon feature.
Example: Cartographers use polygons to show boundaries and they all have an area (a building footprint has a square-footage & agricultural fields have acreage)

Raster types: Discrete vs Continuous.

Raster data is made up of pixels cells referred to as grid cells. They are usually regularly spaced & square but they don't have to be. Rasters often look pixelated because each pixel has its own value or class

For example: Each pixel value in a satellite image has a red, green & blue value. Alternatively each value in an elevation map represents a specific height. It could represent anything from rainfall to land cover.

Raster models are useful for storing data that varies continuously for example elevation surfaces, temperature & lead contamination

Discrete Raster have distinct values.

Discrete rasters have distinct themes or categories example: one grid cell represents a land cover class or soil types.

Continuous Raster have gradual change.

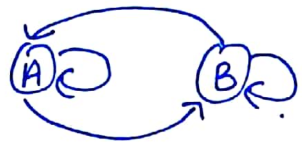
Continuous raster are grid cell with gradual changing data such as elevation, temperature or an aerial photograph.

A continuous raster surface can be derived from a fixed registration point for example digital elevation model use sea level as a registration point

2) B

Markov chain model.

It is a mathematical system that hop from one state to another. It is a random process that undergoes transition from one state to ~~another~~ another on a state space. It must ... in a discrete step. It is required to process a ~~prob~~ property that is usually characterized as "memorylessness"



Example

(1) Board games played with dice. A game of snake & ladder or any game whose moves are determined by dice only is a ~~mar~~ markov chain.

(2) A center biased random walk.
considering a random walk on an number line where at each step. the position (may change by +1 (to right) or −1 (to left) with possibilities

$$P\text{ move left} = \frac{1}{2} + \frac{1}{2}\left(\frac{x}{c+|x|}\right)$$

$$P\text{ move right} = 1 - P\text{ move right}.$$

when c is a constant > 0.

(3) Gambling

(4)

B(ii)

$$\begin{array}{c c} & \begin{array}{cc} x_1 & x_2 \end{array} \\ \begin{array}{c} x_1 \\ x_2 \end{array} & \begin{pmatrix} 0.8 & 0.2 \\ 0.9 & 0.1 \end{pmatrix} \end{array}.$$

long term prediction.

$0.8x_1 + 0.9x_2 = x_1 \rightarrow 1$

$0.3x_2 + 0.1x_2 = x_2 \rightarrow 2.$

$x_1 + x_2 = 1 \quad - 3$

$(x_1 = 1 - x_4) \Rightarrow 4.$

$\therefore$ put 4 in 1 we get :

$0.8(1 - x_2) + 0.9x_2 = 1 - x_2$

$0.8 - 0.8x_2 + 0.9x_2 = 1 - x_2$

$\cancel{+}0.2 = \cancel{+}x_2(1 + 0.9 - 0.8)$

$0.2 = x_2(1.1)$

$x_2 = 0.1818$

substitute $x_2 = 0.1818$ in 4

$x_1 = 1 - 0.1818$

$x_1 = 0.8182.$

$x_1 = 82\%.$

$x_2 = 18\%$

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$$\begin{array}{c|cc} & A & B \\ \hline A & 0.8 & 0.2 \\ B & 0.9 & 0.1 \end{array}$$

$$\begin{array}{cc} & \text{A} \quad\quad \text{B} \\ \begin{array}{c} A \\ B \end{array} & \begin{pmatrix} 0.8 & 0.2 \\ 0.9 & 0.1 \end{pmatrix} \end{array}$$

$A = 52\%$ $\quad$ $B = 48\%$.

Market state after 1 month.

$$\begin{pmatrix} 0.52 & 0.48 \end{pmatrix} \begin{pmatrix} 0.8 & 0.2 \\ 0.9 & 0.1 \end{pmatrix}$$

$$(0.848, \; 0.157) \text{ Ans}$$