Subject ______ Date: __/__/__ MON TUE WED THR FRI SAT SUN

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Pen and Paper Assignment

Vocabulary = { ~~cats~~ cute, funny, ~~dogs~~ animals, cats, dogs
are, and, rarely, get, along }

Word vector = [cats, dogs, cute, funny, animals, rarely, get, along, are, and]

Dimension of Word Vector = 10

Count vector1 = [1, 0, 1, 1, 0, 0, 0, 0, 1, 1]
Count vector 2 = [0, 1, 0, 1, 1, 0, 0, 0, 1, 0]
Count vector 3 = [1, 1, 0, 0, 0, 1, 1, 1, 0, 1]

$$\text{Matrix} = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$$

Shape = 3×10 Matrix
Rows relate with Posts and Column relate with word vector

P(cat) = p for each word
If post has 10 words, probability of no occurence of "cat"
$= (1-p)^{10}$

P(at least one occurence of cat in 10 words) $= 1-(1-p)^{10}$

P(cat-type post for a post of length L) $= 1-(1-p)^{L}$

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Count vector 1: [1,0,1,1,0,0,0,0,1,1]

Probability vector 1: ~~[0.25, 0, 0.25, 0.25, 0,0,0,0]~~

[0.2, 0, 0.2, 0.2, 0, 0, 0, 0, 0.2, 0.2]

Count vector 2: [0,1,0,1,1,0,0,0,1,0]

Probability vector 2: ~~[0, 0.33, 0, 0.33, 0.33, 0,0,0]~~

[0, 0.25, 0, 0.25, 0.25, 0, 0, 0, 0.25, 0]

Count vector 3: [1,1,0,0,0,1,1,1,0,1]

Probability vector 3: ~~[0.2, 0.2, 0, 0, 0, 0.2, 0.2, 0.2]~~

$[\frac{1}{6}, \frac{1}{6}, 0, 0, 0, \frac{1}{6}, \frac{1}{6}, \frac{1}{6}, 0, \frac{1}{6}]$

Probability of Post A being a cat-type post

~~P(A)~~

$$= 1-(1-p)^5$$
$$= 1-(1-0.2)^5$$
$$= 1-(0.8)^5$$
$$= 0.67232$$

Probability of Post C being cat type

~~P(C)~~

$$= 1-\left(1-\frac{1}{6}\right)^5$$
$$= 1-\left(\frac{5}{6}\right)^5 = 0.598714$$

$$P\left(\begin{array}{l}\text{contains word cute} \\ \text{given it is a cat type post}\end{array}\right) = \frac{1}{2} = 0.5$$

$$P\left(\begin{array}{l}\text{cat type given it contains} \\ \text{word cute}\end{array}\right) = \frac{P(\text{cute}/\text{cat type post}) \cdot P(\text{cat type post})}{P(\text{cute containing})}$$

$$= \frac{(0.5) \cdot (2/3)}{(1/3)} = 1$$

Subject upvotes defined by -:

$$U(L) = -\frac{1}{20}L^2 + 3L$$

$$U'(L) = -\frac{L}{10} + 3 = 0$$

Max upvotes $\Rightarrow$ $\boxed{L = 30}$

$$U''(L) = \frac{-1}{10} < 0$$ So, maxima

$$P(L,p) = 1 - (1-p)^L$$

$$G(L,p) = \left(1 - (1-p)^L\right)\left(-\frac{1}{20}L^2 + 3L\right)$$

Taking p very small and L tending to ∞

$$= \left(1 - \left(1 - Lp + \frac{L(L-1)}{2}p^2\right)\right)\left(\frac{-1}{20}L^2 + 3L\right)$$

$$= \left(Lp + \frac{L^2}{2}p^2 - \frac{L}{2}p^2\right)\left(\frac{-1}{20}L^2 + 3L\right)$$

$$= \left(\frac{p}{L} + \frac{p^2}{2} - \frac{p^2}{2L}\right)\left(\frac{3}{L} - \frac{1}{20}\right)$$

As $L \to \infty$

$$= \frac{p^2}{2}\left(\frac{-1}{20}\right) = \frac{-p^2}{40}$$

Can't seem find the solution

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