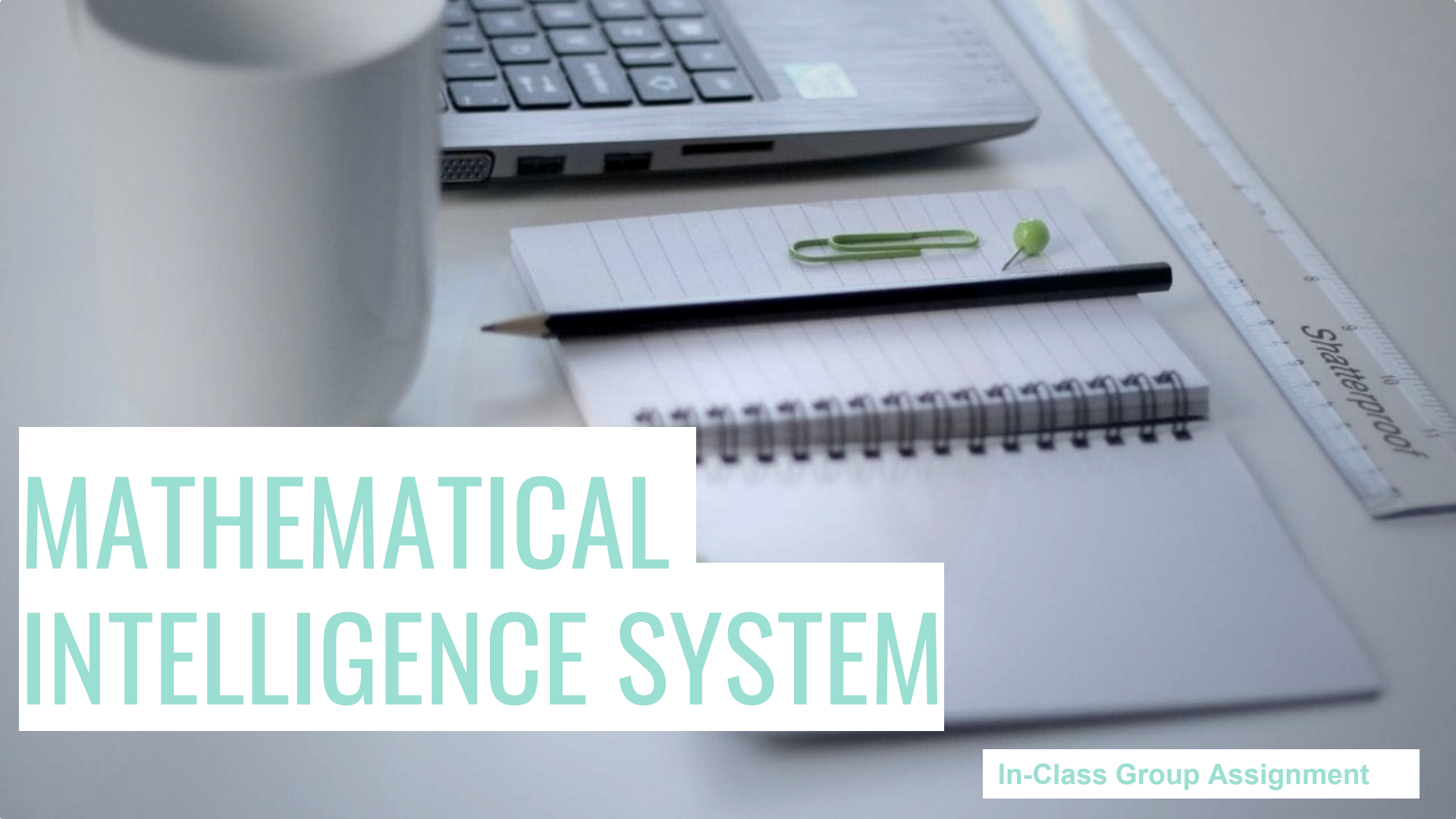

MATHEMATICAL INTELLIGENCE SYSTEM

In-Class Group Assignment

TEAM PRESENTATION

BATCH-A TEAM-7		
GAJULA SRI VATSANKA	CB.EN.U4AIE.21010	Q1
GUNNAM HIMAMSH	CB.EN.U4AIE.21014	Q2
M.PRASANNA TEJA	CB.EN.U4AIE.21035	Q3
VIKHYAT BANSAL	CB.EN.U4AIE.21076	Q4

M.PRASANNA TEJA

1

Given that 42% of high school students would admit to lying at least once to a teacher during the past year and that 25% of students are male and would admit to lying at least once to a teacher during the past year. Assume that 50% of the students are male.

i. What is the probability that a randomly selected student is either male or would admit to lying to a teacher, during the past year?

ii. A student is selected from the subpopulation of those who would admit to lying to a teacher during the past year. What is the probability that the student is female?

SOLUTION

Event A = student admit lying to teacher at least once during past year

Event M = student who is selected is a male

Event(A∩M) = student who admit lying to teacher during past year is a male

Event F = student who is selected is a female

So as given in the question students who admit lying is 42%, student selected is a male is 50% and student who admit lying is a boy is 25%

Then the probability of occurring event A will be 42%

Then the probability of occurring event M will be 50%

Then the probability of occurring event $(A \cap M)$ will be 25%

$$P(A) = 0.42$$

$$P(M) = 0.50 \qquad P(F) = 0.50$$

$$P(A \cap M) = 0.25$$

i) The probability that a randomly selected student is either male or would admit lying to a teacher during the past year is given by $P(A \cup M)$.

$$P(A \cup M) = P(A) + P(M) - P(A \cap M)$$

$$= 0.42 + 0.5 - 0.25$$

$$= 0.67$$

$$P(A \cup M) = 0.67$$

ii) Now the probability that the selected student is a female given that student would admit to lying to a teacher during the past exam is given by P(F/A) and we can write

$$P(F/A) = 1 - P(M/A)$$

$$P(M/A) = P(A \cap M)/P(A)$$ (Conditional probability formula)

$$= 0.25/0.42$$

P(M/A) = 0.5952

Hence,

$$P(F/A) = 1 - P(M/A)$$

$$= 1 - 0.5952$$

$$P(F/A) = 0.4048$$

i) $\mathbf{P(A \cup M) = 0.67}$

ii) P(F/A)= = 0.4048

GUNNAM HIMAMSH

2

A household is categorized as ‘Prosperous’ if its income exceeds $80,000. Similarly, a household is categorized as ‘Educated’ if at least one of the members has completed college. The current Population Surveysays that of all the households 15.2% are prosperous, 34.1% are educated, and 9% are both prosperous and educated. From this information, estimate.

i. The probability that a house hold selected is either prosperous or educated?

Ii. The probability that at least one person in a household is educated, given it is not prosperous.

i) Probability of a family being prosperous is P(pros) = 0.152
Probability of a family being educated is P(edu) = 0.341
Probability of a family being prosperous and educated P(pros ∩ **edu**) = 0.09

Let the probability of the event, a family being either prosperous or educated be P(A)

P(A) = P(pros U edu) = P(pros) + P(edu) – P(pros ∩ **edu**)
= 0.152 + 0.341 – 0.09
= 0.403

Probability of a family being NOT prosperous is P(not pros) = 1-0.152 = 0.848
Probability of a family being prosperous and educated

P(not pros∩ **edu**) = P(edu) – P(pros ∩ **edu**)

= 0.341 – 0.09 = 0.251

Let the probability of the event, atleast one person in a household is educated given it is not prosperous be P(B)

P(B) = P(pros U edu) = P(not pros ∩ **edu**) / P(not pros)

= 0.251 / 0.848

= 0.296

GAJULA SRI VATSANKA

People with albinism have little pigment in their skin, hair, and eyes. The gene that governs albinism has two forms (called alleles), which we denote by a and A. Each person has a pair of these genes, one inherited from each parent. A child inherits one of each parent's two alleles independently with probability 0.5. Albinism is a recessive trait, so a person is albino only if the inherited pair is aa.

i. Alan's parents and his sister Beth are not albino, but he is. What can you infer about the gene type present in Alan's parent?

ii. Which of the types aa, Aa, AA could a child of Alan's parents have? What is the probability of each type?

iii. Given Beth is not an albino. What are the probabilities for Beth's possible genetic types, given this fact?

3

Part-i

According to the given question ,there are 4 different gene types: aa,aA,AA,Aa

- Now, we have been given that Alan is an albino ,so he must be of the gene type of "aa".
- As Alan parents are not albinos, there gene type probably should be "Aa" or "aA".
- Since Alan is an albino ,if anyone of his parent's gene is AA ,he won't be an Albino.
- So, it's mentioned that his are not Albino ,which means their gene type is neither "Aa" or "aA".

Part-ii

- As we know that Alan's parent can't have a gene type of "aa" and "AA".
- So, the probability of Alan's parent's child having the gene type

1) aa, P(aa) = 1/4
2) AA, P(AA) =1/4
3) Aa, P(Aa) =1/4
4) aA, P(aA) =1/4

- A child of Alan parent's can have all the 4 possible combination of gene types.
- Also if Aa and aA are same gene types P(Aa)=P(aA)=1/2

Part-iii

- But,
  Alan's parent can have gene type of "Aa" and "aA".
- As Beth is not an Albino, Probability of her having the gene type is:

1) aA, P(aA)=1/3
2) Aa, P(Aa)=1/3
3) AA, P(AA)=1/3
 if Aa and aA are same gene types
P(aA)=2/3 : P(Aa)=2/3

- P(Aa)=P(aA)=P(AA)=1/3 ,since she can contain only 3 gene types.
- As this selection of any one type of gene among the possible 3 gene types will be equal to 1/3

VIKHYAT BANSAL

4

A continuous random variable is said to have a probability density function given below. $f(x)=\{ce^{-x}\ x\geq 0$
$0 \quad x<0$

I. Detail on how to verify if the given function is a PDF. Identify the values of c for which the PDF is valid.

ii. Find the cumulative distribution function of x.

iii. Estimate the probability of the random variable not being in the range (3,5).

(i) for a function to be probability density function, following properties must follow :-

(I) $f(x) \geq 0$

given continuous random variable is

$$f(x) = \begin{cases} ce^{-x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

Now $ce^{-x} \geq 0$, for all values of x e^{-x} will be +ve and for all positive values of constant c

$ce^{-x} \geq 0$

(ii) Sum of all probabilities = 1

$$\int_{-\infty}^{\infty} f(x)\,dx = 1$$

$$\int_{0}^{\infty} ce^{-x}\,dx + \int_{-\infty}^{0} 0\,dx = 1$$

$$\left[-ce^{-x}\right]_{0}^{\infty} = 1$$

$$ce^{-0} - \lim_{b\to\infty} ce^{-b} = 1$$

$$c(1) - 0 = 1$$

$$c = 1$$

(ii)

$$F(x) = \begin{cases} \int e^{-x}\,dx & x \geq 0 \\ \int 0\,dx & x < 0 \end{cases}$$

$$F(x) = \begin{cases} -e^{-x} + c & x \geq 0 \\ 0 \end{cases}$$

to solve for c

W.R.T $f(\infty) = 1$

$$-e^{-\infty} + c = 1$$

$$c = 1$$

$$f(x) = \begin{cases} (-e^{-x} + 1) \; ; & x \geq 0 \\ 0 \; ; & x < 0 \end{cases}$$

(iii) Probability of Random Variable not in (3, 5)

$= P(x < 3 \ \& \ x > 5)$

$= \int_{-\infty}^{3} f(x)dx + \int_{5}^{\infty} f(x)dx$

$= \int_{-\infty}^{0} f(x)dx + \int_{0}^{3} f(x)dx + \int_{5}^{\infty} f(x)dx$

$= 0 + [-e^{-x}]_0^3 + [-e^{-x}]_5^{\infty}$

$= -e^{-3} - (-1) + (-0 - (-\frac{1}{e^5}))$

$= 1 + e^{-5} - e^{-3}$

$= 1 + 0.0067 - 0.0497$

$= 0.9569$

THANK YOU