# MSIT 431: PROBABILITY AND STATISTICAL METHODS

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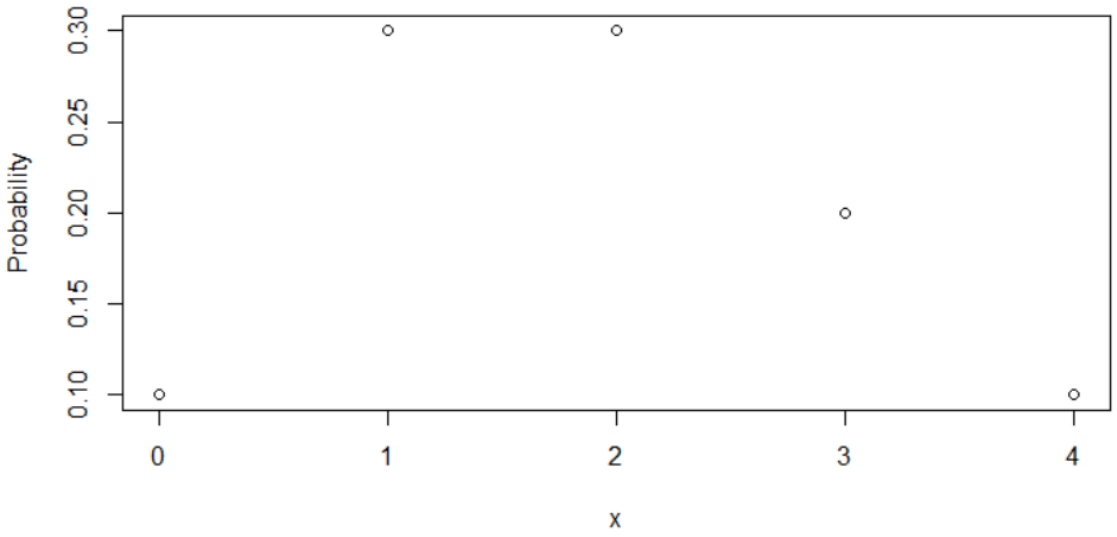
**Ques 1. Textbook Exercise 4.57**

**Solution (a)**




**(b)** At least one non word error: X>=1

Probability of one non word error P(X>=1) = 1-P(0)

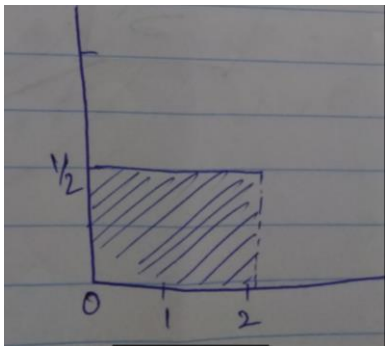
=1-0.1

=0.9

**(c)** Event X <=3 implies there can be up to 3 non- word errors, X could take value 0 or 1 or 2 or 3. Probability of X<3 is P(0)+P(1)+P(2)=0.1+0.3+0.3=0.7

**Ques 2. Textbook Exercise 4.59**

**Solution (a)** Since the total area under the density curve is 1 and random variable can take value between 0 and 2. The height of the density curve is ½




**Solution (b)** P(Y<=1.6)=1/2*1.6

=0.80

**Solution (c)** P(0.5<Y<1.7)=(1.7-0.5)*0.5

=0.6

**Solution (d)** P(Y>=0.95)= (2-0.95)*0.5

=0.525

**Ques 3. Textbook Exercise 4.62**

**Solution (a)** P(0.52<=0.56<=0.60)

=P((0.52-0.56)/.019)<=0<=((0.60-0.56)/0.019))

=P(-2.10<=0<=2.10)

=0.9826-0.0174

=0.9652

**Solution (b**) P(p>=0.72)

P(Z>=8.42)

1-P( Z <= 8.421053) = 0
> 1 - pnorm(.72,0.56, 0.019)

=0

**Ques 4. Textbook Exercise 4.71**

Solution (-1)*0.3+(0*0.2)+(1*0.3)+2*(0.2)

=0.4

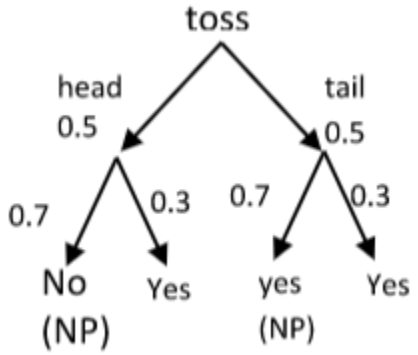
σ2=(-1- 0.4)2*0.3+(0-0.4)2*0.2++(1- 0.4)2*0.3++(2-0.4)2*0.2=0.588+0.032+0.108+0.512=1.24

σ=1.1136

**Ques 5.Textbook Exercise 4.112**

Soution P(A or B)=P(A)+P(B)-P(A and B)=0.138+0.261-0.082=0.317

**Ques 6. Textbook Exercise 4.138**




**Solution** (a) the probability of a No answer in the randomized-response poll is=(1-0.3)*0.5=0.35

(b) if the probability of plagiarism were 0.2, the probability of a No answer on the poll=(1-0.2)*0.5=0.4

(c) 1-39%*2=22%

**Ques 7. Spam Filter**

**Solution** a) P(S| W1 W2) = P(W1 W2 |S )P(S ) / ( P(W1 W2 |S)P(S) + P(W1 W2 |H)P(H))

= P(W1 |S)P(W2 |S )P(S ) / ( P(W1 |S)P(W2 |S)P(S) + P(W1 |H)P(W2 |H)P(H))

= 1 / ( 1 + (P(W1|H)/P(W1 |S )) × (P(W2 |H)/P(W2 |S )))

=1/(1+(0.002/0.4)*(0.004/0.2))=0.9999

b) The probability= P(S|)=1/(1+(0.998/0.6)*(0.004/0.2))=0.9678

**Ques 8. The Importance of Independence.**

**Solution** (a) Sample space : {not A and not B and not C,

A and not B and not C,

not A and not B and C,

A and not B and C,

A and B and not C,

not A and B and not C,

A and B and C,

not A and B and C}

(b) P(A)= ½*p+1/2*q

P(B)=1/2*p+1/2*q

P(A and B)=1/2*p*p+1/2*q*q

Yes they are not independent as P(A)*P(B) is not equal to P(A and B).

(c) P(A|C)=p

P(B|C)=p

P(A and B|C)=$p^2$ =P(A|C)*P(B|C)

Therefore, P(A and B|C) = P(A|C)*P(B|C)

Hence, they are independent conditioned