**Lec 02**

|  |  |
| --- | --- |
| **Set Algebra** | **Probability** |
| * Universal set | * Sample space |
| * Set | * Event |
| * Element | * Outcome |

**Probability of Axioms**

* ** Indicates the probability of an event.**
* For any events , 
* 
* For any countable collection  of mutually exclusive events



Ex] Roll a fair die (6 sided)





**Quiz 1.4]** Monitor a phone call. Classify the call as a voice call (V) if someone is speaking, or a data call (D) if the call is carrying a modem or fax signal. Classify the call as long (L) if the call lasts for more than three minutes; otherwise call as a brief (B). Based on data collected by the telephone company, we use the following probability model: It is given that



Find the following probabilities



|  |  |  |
| --- | --- | --- |
|  | **V** | **D** |
| L | 0.35 (given) |  |
| B |  |  |

 So, 

|  |  |  |
| --- | --- | --- |
|  | **V** | **D** |
| L | 0.35 (given) |  |
| B | 0.35 |  |

 So, 

|  |  |  |
| --- | --- | --- |
|  | **V** | **D** |
| L | 0.35 (given) | 0.25 |
| B | 0.35 |  |

|  |  |  |
| --- | --- | --- |
|  | **V** | **D** |
| L | 0.35 (given) | 0.25 |
| B | 0.35 | 0.05 |

* ?



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**1.5 Conditional probability**

: Probability of  **given** 

Probability of  **conditioned on** 







Conditional probability of Axioms

* 
* 
* If  with  for , then



**Ex 1.16]** consider the a priori probability model shown below



\* 

A=”second chip rejected”

B=”first chip rejected”

Find the conditional probability, 











Ex 1.19] A company has three machine for making  resistors. It has been observed that 80% of resistors produced by  are within 50 of the normal value. Machine  produces 90% of resistors within 50 of the normal value. The percentage for machine  is 60%. Each hour, machine  produces 3000 resistors,  produces 4000 resistors, and  produces 3000 resistors. All of the resistors are mixed together at random in one bin and packed for shipment. What is the probability that the company ships a resistor that is within 50 of the nominal value?



What is ?

Now we can generate the probability model for



Applying the law of total probability



*Revisiting the previous example to show in different angles*

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What is ?

Now we can generate the probability model for







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*A: acceptable*

*N: not-acceptable*

i. =0.3

ii. =0.24 + 0.36 + 0.18 = 0.78

iii.



iv. Conditional probability using *Bay’s theorem*



**1.6 Independence**

Events  and  are independent if and only if (iff)



Events  are independent if and only if (iff)

i.  are independent

ii.  are independent

iii.  are independent

iv. 

**Disjoint (mutually exclusive)  independent**

**Ex 1.21]** A sequence of three light, each either red or green, is equally likely. Are the events  that the second light was red and  that the second light was green independent? Are the events  and  independent?

Sample space 

and each of the outcomes has equal probability of .



 so this is disjoint



So

 Not independent

Now let’s take a look at the different case





This is independent

