# STT 200 – Lecture 1, section 2,4 Recitation 8 (10/23/2012)

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Help-room: (A102 WH) 11:20AM-12:30PM, Monday, Friday

Class meet on Tuesday:
***3:00 – 3:50PM*** A122 WH, Section ***02***
***12:40 – 1:30PM*** A322 WH, Section ***04***

# Overview

- We will discuss following problems:
  - Chapter 14 "*From randomness to Probability*"(Page 381) #19-22, 31-32, 35
  - Chapter 15 "*Probability Rules*" (Page 404) #3-4

- All recitation PowerPoint slides available at here

- Chapter 14 (Page 381): #19:

  Cars need to be repaired

  once: 17%;  twice: 7%;  three or more: 4%

  What is the probability of

  - No repairs?

    Ans: $1 - 0.17 - 0.07 - 0.04 = 0.72$

  - No more than one repair?

    Ans: P(no rep.)+P(once) = $0.72 + 0.17 = 0.89$

  - Some repairs?

    Ans: 1-P(no rep.) = $1- 0.72 = 0.28$

- Chapter 14 (Page 381): #20:

  Students take a Calculus course

  never: 55%;  one semester: 32%;  two or more: the rest

  What is the probability of

  - Two or more semesters of Calculus?

    Ans: $1 - 0.55 - 0.32 = 0.13$

  - Some Calculus?

    Ans: 1-P(never) $= 1 - 0.55 = 0.45$

  - No more than one semester of Calculus?

    Ans: P(never)+P(one) $= 0.55 + 0.32 = 0.87$

- Chapter 14 (Page 381): #21:

  Cars need to be repaired

  once: 17%;  twice: 7%;  three or more: 4%

  If you own two cars, the probability that

  - No need for repairs for both?

    Ans: For each of the two cars, P(no rep.) = 1 – 0.17 – 0.07 – 0.04 = 0.72;  So for both of them the answer is 0.72*0.72 = 0.5184

    (Details: if let the event A be "1st car need no repair", B be "2nd car need no repair", A and B are independent. So P(A and B) = P(A)*P(B). Here P(A) = P(B) = 0.72)

- Chapter 14 (Page 381): #21 (Continued):

Cars need to be repaired

once: 17%;  twice: 7%;  three or more: 4%

If you own two cars, the probability that

- Need repairs for both?

Ans: Similar as last question, for each car, the probability of needing repair is P(need repair) = 1 - P(no rep.) = 1 – 0.72 = 0.28; So for both, 0.28^2 = 0.0784

- At least one car will need repair?

Ans: The opposite event is “None of the two need repair”, that is “No need for repairs for both”, which is calculated with prob. 0.5184. So the answer  is 1 – 0.5184 = 0.4816

- Chapter 14 (Page 381): #22:

  Students take a Calculus course

  never: 55%;  one semester: 32%;  two or more: the rest

  What is the probability that your other two groupmates

  - neither has studied Calculus?

    Ans: 0.55^2 = 0.3025

  - both have studied at least one semester?

    Ans: P(at least one semester) = 1-P(never) = 1 – 0.55 = 0.45; So for both students, the answer is 0.45*0.45 = 0.45^2 = 0.2025

  - at least one has had more than one semester?

    Ans: The opposite event of “at least one has more than one semester” is “none of them have more than one semester”, or rather, “both of them have less or equal  one semester”. Now:

    P(one has less or equal  one semester) = P(never) + P(one sem.) = 0.55+0.32 = 0.87. So for both of them, the answer is 0.87* 0.87.

    Finally the answer for the original event that is asked, is

    1- 0.87* 0.87 = 0.2431

- Chapter 14 (Page 381): #22:

  Students take a Calculus course

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  What is the probability that your other two groupmates

  - neither has studied Calculus?

    Ans: 0.55^2 = 0.3025

  - both have studied at least one semester?

    Ans: P(at least one semester) = 1-P(never) = 1 – 0.55 = 0.45; So for both students, the answer is 0.45*0.45 = 0.45^2 = 0.2025

  - at least one has had more than one semester?

    Ans: The opposite event of “at least one has more than one semester” is “none of them have more than one semester”, or rather, “both of them have less or equal  one semester”. Now:

    P(one has less or equal  one semester) = P(never) + P(one sem.) = 0.55+0.32 = 0.87. So for both of them, the answer is 0.87* 0.87.

    Finally the answer for the original event that is asked, is

    1- 0.87* 0.87 = 0.2431

- Summary

  - For multiple subjects (examples here are cars, students, etc.), we find the probability for each. The answer is usually the product of their individual answer.

  - It is usually easier to work on "All/None of the subjects are/aren't ……". When you see "At least/At most/Not all", etc., usually it is easier to consider the complement event, find its probability, and subtracted by 1.

  - Difference between disjoint event and complement event:

A and B are disjoint: *If A happens, B can not happen*. We have P(A or B) = P(A) + P(B)

A and are complement: *If A happens, B can not happen;*

*if A does not happen, B must happen*. We have P(A)+P(B) = 1

- Chapter 14 (Page 382): #31:

  Percentages that candies made up of their plain M&M's

  yellow: 20%; red: 20%, orange 10%, blue 10%, green 10%

  The rest were brown.

  - Probability of
    - brown?
    - yellow or orange?
    - not green?
    - striped?
  - If you pick three, what is the probability of
    - all Brown?
    - the third one is the first one that's red? (*i.e., first two are not red but the third one is red*)
    - none are yellow?
    - at least one is green?

- Chapter 14 (Page 382): #31 (Continued):

  Percentages that candies made up of their plain M&M's

  yellow: 20%; red: 20%, orange 10%, blue 10%, green 10%

  The rest were brown.

  - Probability of
    - brown? *1 – 0.2 *2 – 0.1 *3 = 0.3*
    - yellow or orange? *0.2 + 0.1 = 0.3*
    - not green? *1 – 0.1 = 0.9*
    - striped? *0.0*
  - If you pick three, what is the probability of
    - all Brown? *0.3^3 = 0.027*
    - the third one is the first one that's red? *0.8*0.8*0.2 = 128*
    - none are yellow? *(1-0.2)^3 = 0.512*
    - at least one is green? *1 – (1-0.1)^3 = 0.271*

- Chapter 14 (Page 382): #32:

  Blood type:

  Type O: 45%; Type A: 40%, Type B: 11%, the rest Type AB

  - Probability of
    - Type AB?
    - Type A or Type B?
    - not Type O?
  - Four donors, probability of
    - all Type O?
    - no one is Type AB?
    - not all Type A?
    - at least one is Type B?

- Chapter 14 (Page 382): #32 (Continued):

  Blood type:

  Type O: 45%; Type A: 40%, Type B: 11%, the rest Type AB

  - Probability of
    - Type AB? *1 – 0.45 – 0.4 – 0.11 = 0.04*
    - Type A or Type B? *0.4 + 0.11 = 0.51*
    - not Type O? *1 – 0.45 = 0.55*
  - Four donors, probability of
    - all Type O? *(0.45)^4 = 0.041*
    - no one is Type AB? *(1-0.04)^4 = 0.849*
    - not all Type A? *1 – 0.4^4 = 0.974*
    - at least one is Type B? *1 – (1-0.11)^4 = 0.373*
  - Hint: Draw Venn Diagram.

- Chapter 15 (Page 404): #3:

  Rooms on a college campus

  38% had refrigerators, 52% had TVs, 21% had both.

  What is the probability of

  - a TV but no refrigerator?

    $0.52 - 0.21 = 0.31$

  - a TV or a refrigerator, but not both?

    $0.38 + 0.52 - 0.21 = 0.69$; $0.69 - 0.21 = 0.48$

  - Neither a TV nor a refrigerator?

    $1 - 0.69 = 0.31$

- Chapter 15 (Page 404): #3:

  Employment data on workers in a company

  72% married, 44% college graduates, half of the grads are married.

  What is the probability of

  - neither married nor a college graduate?

    Married or Graduate: $0.72 + 0.44 - 0.22 = 0.94$

    Therefore $1 - 0.94 = 0.06$

  - married but not a college graduate?

    $0.72 - 0.22 = 0.5$

  - married or a college graduate?

    0.94

- Hint: Draw Venn Diagram.

Thank you.