CS 3341
Homework 1

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Question 1

Out of six computer chips, two are defective. If two chips are randomly chosen for testing (without replacement), compute the probability that both of them are defective. List all the outcomes in the sample space

Solution: The sample space is

$$\Omega = \{(1,2),(1,3),(1,4),(1,5),(1,6),(2,3),(2,4),(2,5),(2,6),(3,4),(3,5),(3,6),(4,5),(4,6),(5,6)\}$$

Giving us the following probability

$$\frac{2}{6} \cdot \frac{1}{5} = \frac{2}{30} = \frac{1}{15}$$

that both of them are defective. 😄

Question 2

Suppose that after 10 years of service, 40% of computers have problems with motherboards (MB), 30% have problems with hard drives (HD), and 15% have problems with both MB and HD. What is the probability that a 10-year old computer still has fully functioning MB and HD?

Solution: The probability that a 10-year old computer still has a fully functioning MB and HD is derived by the following

$$1 - (0.40 + 0.30 - 0.15) = 0.45 \rightarrow 45\%$$

so a 45% chance the computer has a fully functioning MB and HD after 10-years of service. 😊

Question 3

A new computer virus can enter the system through e-mail or through the internet. There is a 30% chance of receiving this virus through e-mail. There is a 40% chance of receiving it through the internet. Also, the virus enters the system simultaneously through e-mail and the internet with probability 0.15. What is the probability that the virus does not enter the system at all?

Solution: The probability that the virus does not enter the system at all is derived by the following

$$1 - (0.30 + 0.40 - 0.15) = 0.45 \longrightarrow 45\%$$

so a 45% chance the virus does not enter the system at all. 😄

Question 4

Among employees of a certain firm, 70% know C/C++, 60% know Fortran, and 50% know both languages. What portion of programmers...
(a) does not know Fortran?
(b) does not know Fortran and does not know C/C++?
(c) knows C/C++ but not Fortran?
(d) knows Fortran but not C/C++?

Solution: **(a)** 40% of programmers don't know Fortran b/c $1 - 0.60 = 0.40 \rightarrow 40\%$

(b) 20% of programmers don't know Fortran and C/C++ b/c $1 - (0.70 + 0.60 - 0.50) = 0.20 \rightarrow 20\%$

(c) 20% of programmers know C/C++ but don't know Fortran b/c $0.70 - 0.50 = 0.20 \rightarrow 20\%$

(d) 10% of programmers know Fortran but don't know C/C++ b/c $0.60 - 0.50 = 0.10 \rightarrow 10\%$ 😊

Question 5

Consider a fair coin which when tossed results in either heads (H) or tails (T). The coin is tossed two times.
(a) Write the sample space (Order matters here. So, HT and TH are not the same outcome).

(b) List all possible events and compute the probability of each event, assuming that the probability of each possible outcome is equal (Keep in mind that there should be much more events than outcomes and not all events will have the same probability).

Solution: **(a)** The sample space is

$$\Omega = \{HH, HT, TH, TT\}$$

(b) The probability of Heads and Heads is $\frac{1}{4}$

The probability of Heads and Tails is $\frac{1}{4}$

The probability of Tails and Heads is $\frac{1}{4}$

The probability of Tails and Tails is $\frac{1}{4}$

The probability of one instance of head is $\frac{3}{4}$

The probability of one instance of Tails is $\frac{3}{4}$

The probability of Heads and Heads and Tails and Tails is $\frac{2}{4}$. ☺

Question 6

A fair dice (six-sided) is rolled twice. What is the probability that the sum of the numbers rolled will add up to seven? List the outcomes representing the sum of 7.

Solution: The same space is

$$\begin{aligned}\Omega = \{&(1,1),(1,2),(1,3),(1,4),(1,5),(1,6)\\ &(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)\\ &(3,1),(3,2),(3,3),(3,4),(3,5),(3,6)\\ &(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)\\ &(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)\\ &(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)\}\end{aligned}$$

There is a $\frac{1}{6}$ chance that the numbers rolled will add up to 7 b/c $\{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\} = \frac{6}{36} = \frac{1}{6}$ 😊