1 Probability Theory Review

1.1 Probabilistic Independence

a) With rolling the dice twice you have 36 different outcomes. Event A gets fullfilled in 3 cases. 12 cases fullfil event B and C. Event D gets fullfilled in 15 cases. And 22 cases for Event E. This results in following Propabilties for the different events:

$$P(A) = \frac{3}{36} = \frac{1}{12}$$
$$P(B) = \frac{12}{36} = \frac{1}{3}$$
$$P(C) = \frac{12}{36} = \frac{1}{3}$$
$$P(D) = \frac{15}{36} = \frac{5}{12}$$
$$P(E) = \frac{22}{36} = \frac{11}{18}$$

b) Event A and B get satisfied in the cases (6,5),(5,6),(6,6) to show dependece we have to show following equation.

$$P(A \cap B) \neq P(A)P(B)$$
$$\frac{3}{36} \neq \frac{3}{36} * \frac{1}{12}$$

since both sites are not equal we know that A is dependent of event B.

c) $A \cap C$ can not be fullfilled. And since $P(A) > 0$ and $P(C) > 0$ we know that

$$P(A \cap C) = 0 \neq P(A)P(C) > 0$$

Which shows that A is depented of event C.

d) $D \cap E$ gets satisfied by the cases (1,2),(2,3),(3,4),(4,5),(5,6) which implies $P(D \cap E) = \frac{5}{36}$ Since

$$P(D \cap E) = \frac{5}{36} \neq \frac{55}{216} = \frac{5}{12} * \frac{11}{18} = P(D)P(E)$$

we know that D and E are dependend.