Statistics for Data Science
Unit 3 Homework Submission
Ted Pham

1. P(R) = 0.4, P(M) = 0.35, P(P) = 0.25
   P(F|R) = 0.3, P(F|M) = 0.6, P(F|P) = 0.5

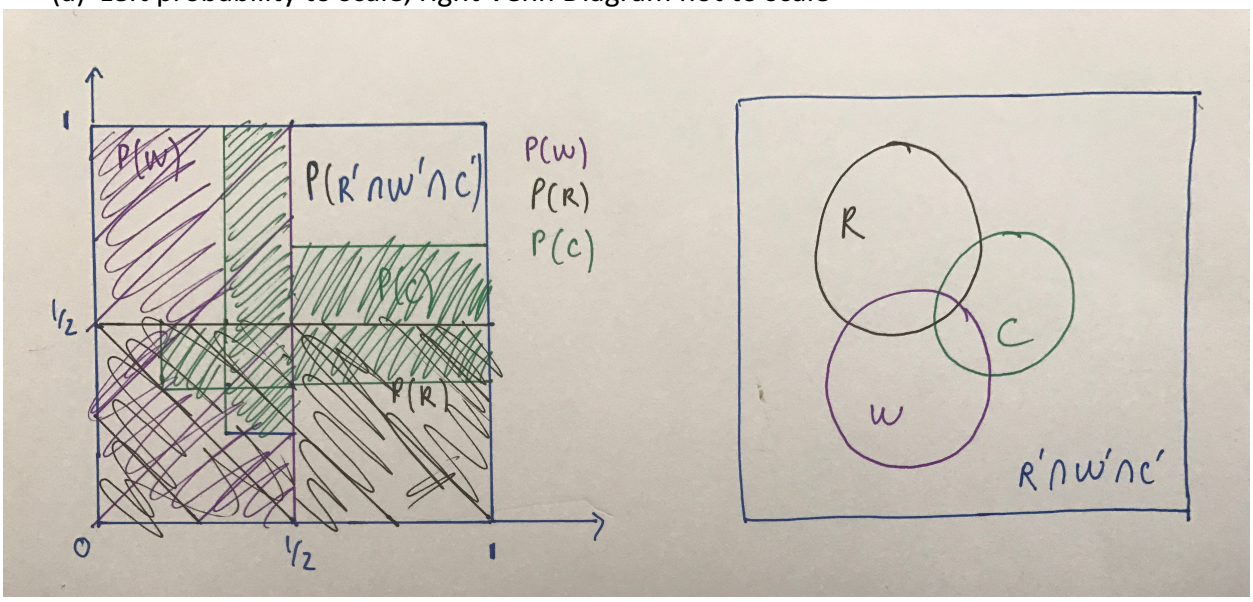
   P(R ∩ F) = P(F|R)*P(R) = 0.12
   P(M ∩ F) = P(F|M)*P(M) = 0.21
   P(P ∩ F) = P(F|P)*P(P) = 0.125

   (a) P(R ∩ F) = $\boxed{0.12}$
   (b) P(F) = P(R ∩ F) + P(M ∩ F) + P(P ∩ F) = $\boxed{0.455}$
   because P(R) + P(M) + P(P) = 1
   (c) P(R|F) = P(R ∩ F)/P(F) = 0.12/0.455 = $\boxed{0.263}$

2. P(R) = 1/2
   P(W) = 1/2
   P(C) = 1/3

   P(R ∩ W) = 1/4
   P(R ∩ C) = 1/6
   P(W ∩ C) = 1/6
   P(R' ∩ W' ∩ C') = P(R U W U C)' = 1/6
   P(R U W U C) = 1 – P(R U W U C)' = 5/6

   (a) Left probability to scale, right Venn Diagram not to scale



(b) From set theory:

$P(R \cup W \cup C) = P(R) + P(W) + P(C) - P(R \cap W) - P(R \cap C) - P(W \cap C) + P(R \cap W \cap C)$

$\Rightarrow P(R \cap W \cap C) = P(R \cup W \cup C) - P(R) - P(W) - P(C) + P(R \cap W) + P(R \cap C) + P(W \cap C)$

$\boxed{\Rightarrow P(R \cap W \cap C) = 1/12}$

(c) $P(C' \mid R) = 1 - P(C \mid R)$

$= 1 - P(C \cap R)/ P(R) = 1 - (1/6)/(1/2)$

$\boxed{\Rightarrow P(C' \mid R) = 2/3}$

(d) $P(C \mid (W \cup R)) = P(C \cap (W \cup R)) / P(W \cup R)$

$= \{ P(C) + P(W \cup R) - P(C \cup W \cup R) \} / \{P(W) + P(R) - P(W \cap R) \}$

$= \{ 1/3 + 3/4 - 5/6)/(3/4) = 1/3$

$\boxed{\Rightarrow P(C \mid (W \cup R)) = 1/3}$

3. (a)

(because A & B might not belong in a set) $\boxed{0 =< P(A \cap B) =< 1/2}$ = min (P(A),P(B))

(b) from (a) we get $\boxed{0 <= P(A|B) <= (1/2)/P(B) = 3/4}$

4. Let P(S) be the probability of students that like Statistics and P(C) the probability that students complete w203.
then from the given information

$P(S|C) = 3/4$
$P(S|C') = 1/4$
$P(C) = 1/100$
$P(C') = 99/100$

$P(S) = P(S|C)*P(C) + P(S|C')*P(C')$
$= 102/400$

$P(C \cap S) = P(S|C)*P(C) = 3/400$

$P(C|S) = P(C \cap S) / P(S) = 3/102$

$\boxed{P(C|S) = 1/34 = 0.029}$