QUESTION 1

1a) {(jack,Jim), (jack,Joe), (jack, jill), (jack,Jane), (Jim, joe), (Jim, Jill), (Jim, jane), (Joe, Jill), (Joe, Jane), (Jill, Jane)}
Sample Points = 10

1b)
A= {(jack, Jill)}
sample points = 1
$P(A)=1/10=0.1$
B={(jack, jill), (Jim, Jill), (Joe, Jill), (Jill, Jane)}
sample points = 4
$P(B)=4/10=2/5=0.4$
C= {(Jim, Jill), (Jim, jane), (Joe, Jill), (Joe, Jane), (Jill, Jane), (jack, jill), (jack,Jane)}
sample points = 7
$P(C)=7/10=0.7$
D= {(Jim, Jill), (Jim, jane), (Joe, Jill), (Joe, Jane),(jack, jill), (jack,Jane)}
sample points = 6
$P(D)=6/10=3/5=0.6$

1c) $A \subseteq B$, $A \subseteq C$, $A \subseteq D$, $B \subseteq C$, $D \subseteq C$

1d) **mutually exclusive:** $A \cap B = \varnothing$.
None of the events are mutually exclusive as events A, B, C and D can occur simultaneously (intersection of any events does not result in an empty sample space)

Question 2

Axiom 1 $P(A) \geq 0$
Axiom 2 $P(S) = 1$
Axiom 3 for A, B disjoint events, $P(A \cup B) = P(A) + P(B)$

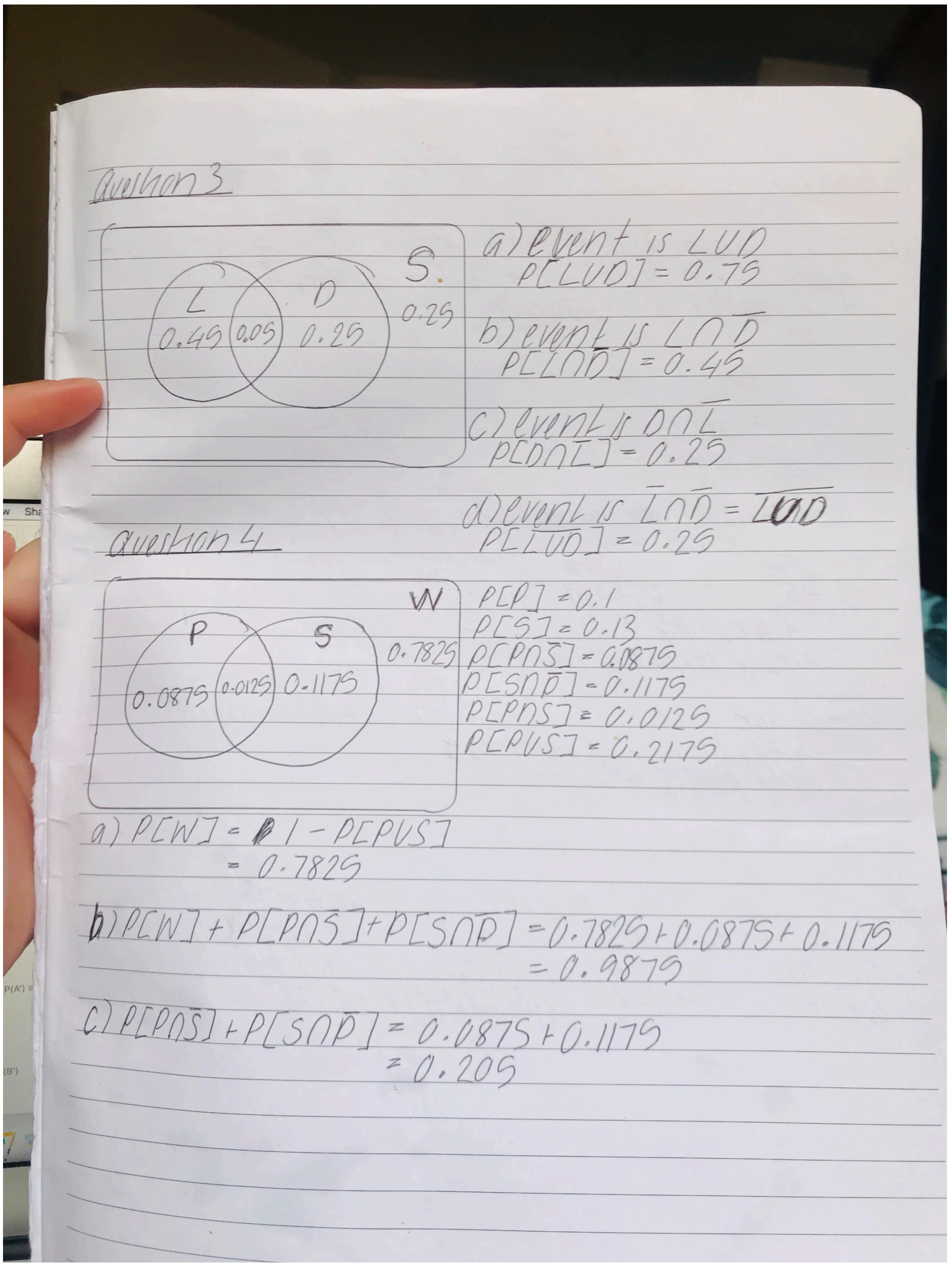
A)
$P(A') = 1 - P(A)$
$(A \cup A') = S$
$P(S)=1$ **<Axiom 2 $P(S) = 1$**
$P(A \cup A') = 1$ **< Substitution < $A \cup A'$ is disjoint**
$P(A) + P(A') = P(A \cup A')$ < **Axiom 3 for A, B disjoint events, $P(A \cup B) = P(A) + P(B)$**
$P(A) + P(A') = 1$ **< Substitution**
Therefore
$P(A')= 1 - P(A)$ < rearranged

B)
$P(A \cap B') = P(A) - P(A \cap B)$
Where $(A)= (A \cap B) \cup (A \cap B')$ **< $(A \cap B) \cup (A \cap B')$ is disjoint**
$P(A)= P(A \cap B) + P(A \cap B')$ **<Axiom 3 for A, B disjoint events, $P(A \cup B) = P(A) + P(B)$**
Therefore
$P(A \cap B') = P(A) - P(A \cap B)$ < rearranged

C)
$P(A \cap B) <= P(A)$
$A=(A \cap B')U(A \cap B)$ **< $(A \cap B')U(A \cap B)$ is disjoint**

P(A)=P(A ∩ B')+P(A ∩ B) **<Axiom 3 for A, B disjoint events, P(A ∪ B) = P(A) + P(B)**
P(A ∩ B)=P(A)-P(A ∩ B') **< rearrange**
P(A ∩ B')>=0 **<Axiom 1 P(A) ≥ 0**
P(A)-P(A ∩ B')<=P(A) **< Substitution**
Therefore
P(AnB)<=P(A)

D)
If A implies B, then P(A') ≥ P(B')
A ⊆ B
A'=(B') ∪ (B ∩ A') **< B' ∪ (B ∩ A) is disjoint**
P(A')=P(B') + P(B ∩ A') **<Axiom 3 for A, B disjoint events, P(A ∪ B) = P(A) + P(B)**
P(B') = P(A') - P(B ∩ A') **<rearrange**
P(B ∩ A')>=0 **<Axiom 1 P(A) ≥ 0**
P(B') + P(B ∩ A') >= P(B') + P(B ∩ A') - P(B ∩ A') **<substitution**
P(B') + P(B ∩ A') >= P(B')
Therefore
P(A') ≥ P(B')



Question 3

a) event is $L \cup D$
$P[L \cup D] = 0.75$

b) event is $L \cap \bar{D}$
$P[L \cap \bar{D}] = 0.45$

c) event is $D \cap \bar{L}$
$P[D \cap \bar{L}] = 0.25$

d) event is $\bar{L} \cap \bar{D} = \overline{L \cup D}$
$P[\overline{L \cup D}] = 0.25$

Question 4

$P[P] = 0.1$
$P[S] = 0.13$
$P[P \cap \bar{S}] = 0.0875$
$P[S \cap \bar{P}] = 0.1175$
$P[P \cap S] = 0.0125$
$P[P \cup S] = 0.2175$

a) $P[W] = 1 - P[P \cup S]$
$= 0.7825$

b) $P[W] + P[P \cap \bar{S}] + P[S \cap \bar{P}] = 0.7825 + 0.0875 + 0.1175$
$= 0.9875$

c) $P[P \cap \bar{S}] + P[S \cap \bar{P}] = 0.0875 + 0.1175$
$= 0.205$