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Solution Bank 6.3

① a) $P(A)+P(B)=0.3+0.45=0.75$

b) $1-P(A \text{ or } B)=1-0.75=0.25$

② a) $P(A \text{ or } B)=1-0.3=0.7$

$P(A)+P(B)=0.7 \rightarrow P(A)=0.2$

b) $1-((0.2)+0.5)=0.3$

③ $P(A)=0.6 \quad P(B)=0.4$

$P(A \cap B)=P(A)\times P(B)=0.6\times 0.4$

$=0.24$

④ $P(A)=0.12 \quad P(A \cap B)=0.0204$

$P(A \cap B)=P(A)\times P(B)=0.0204=0.12\times P(B)$

$P(B)=0.0204/0.12=0.17$

⑤ a) $A \cap B=0.2$

A only $=0.45$

B only $=0.3$

$0.45+0.2+0.3=0.95$

$x=1-0.95=0.05$

$x=0.05$

b) $P(A \cap B)=P(A)\times P(B)$

$P(A)=0.45+0.2=0.65$

$P(B)=0.3+0.2=0.5$

$P(A \cap B)=0.2$

$0.65\times 0.5=0.325 \neq 0.2$

$\therefore$ the events are not independant

⑥ $P(Y)=0.4$

$P(Z)=0.5$

$P(Y \cap Z)=0.15$

$P(\text{neither } Y \text{ nor } Z)=0.35$

if independant $\rightarrow P(Y \cap Z)=P(Y)\times P(Z)=0.4\times 0.5$

$=0.2$

given that $\rightarrow P(Y \cap Z)=0.15$

$\therefore$ not independant since $0.15 \neq 0.2$

⑦ a) Given $P(C \cup D)=0.65$

C only $=0.3$

D only $=x$

$C \cap D=0.05$

$D \cap E=y$

mutually exclusive so don't overlap

$\leftrightarrow$ C and D or C and E

b) $P(C)=0.3+0.05=0.35$

$P(D)=x+0.05+y=x+y+0.05$

$0.65=0.35+(x+y+0.05)-0.05$

$0.65=0.35+x+y \rightarrow x+y=0.3$

$y=0.3 \quad x=0$

$x+y=0.45 \neq 0.3$

$x=0.15 \quad y=0.3$

D only $=x$
$D \cap E=y$

c) $P(D)=x+0.05+y=0.15+0.05+0.3$

$=0.5$

$P(E)=y+0.05=0.3+0.05=0.35$

$P(D \cap E)=y=0.3$

$P(D)\times P(E)=0.5\times 0.35=0.175 \neq 0.3$

$\therefore$ student is not correct.

⑧ a) $P(F \cap G)=0.05$

$P(G \cap I)=0.15$

$P(F \cap I)=0.2$

no overlap $\rightarrow$ F and I

b) $x=$ only F $\quad x+y+z+0.05+0.15+0.2=1$

$y=$ only G $\quad x+y+z=1-0.05+0.15+0.2$

$z=$ only I $\quad =1-0.4=0.6$

$P(F)=0.3$

$P(F)=x+0.05+0.2$

$x+0.25=0.3 \rightarrow x=0.05$

$0.05+y+z=0.6 \rightarrow y+z=0.55$

$P(G)=y+0.05+0.15=y+0.2$

$P(I)=z+0.15+0.2=z+0.35$

so $0.15=(y+0.2)(z+0.35)$

$y=0.3 \quad z=0.25 \rightarrow P(G)=0.5, P(I)=0.6$

$P(G)\times P(I)=0.5\times 0.6=0.3 \neq 0.15 \rightarrow$ not independant

$y=0.3 \quad z=0.05 \rightarrow P(G)=0.5, P(I)=0.4$

$P(G)\times P(I)=0.5\times 0.4=0.2 \neq 0.15$

$y=0.3, z=0.05 \quad x=0.25$

$0.25+0.3+0.05=0.6$

$x=0.25$
$y=0.3$
$z=0.05$