1. 12 points (2 / part)

a) $P(A') = 1 - P(A) = 1 - .3 = \boxed{.7}$

b) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$.79 = .3 + .7 - P(A \cap B)$

$P(A \cap B) = 1 - .79 = \boxed{.21}$

c) $P(A' \cup B) = P(A') + \underbrace{P(B) - P(A' \cap B)}_{P(A \cap B)}$

$= .7 + .21 = \boxed{.91}$

d) $P(B|A) = P(A \cap B) / P(A) = .21/.3 = \boxed{.7}$

e) Since $P(B|A) = P(B) = .7$, they are independent

f) m.e. says $A \cap B = \emptyset$. Since $P(A \cap B) > 0$, $A \cap B \neq \emptyset$ so NO

2. 12 points

Let A = Rain Sat B = Rain Sun

Told $P(A) = P(B) = .25$ and $P(B|A) = .75$

Asked for $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

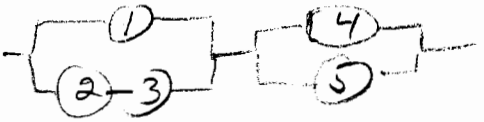
$= P(A) + P(B) - P(A) P(B|A)$

$= .25 + .25 - .25(.75) = \frac{1}{2} - \frac{3}{16} = \frac{5}{16}$

$= \boxed{.3125}$

3. 15 points

Label components



Let w_i = Component i works

Prob system functions $= P\{[w_1 \cup (w_2 \cap w_3)] \cap [w_4 \cup w_5]\}$

$\overset{\text{indep}}{=} P[w_1 \cup (w_2 \cap w_3)] \cdot P[w_4 \cup w_5]$

$= [P(w_1) + P(w_2 \cap w_3) - P(w_1 \cap w_2 \cap w_3)] \cdot [P(w_4) + P(w_5) - P(w_4 \cap w_5)]$

$\overset{\text{indep}}{=} [.98 + (.99)^2 - (.98)(.99)^2][.98 + .98 - (.98)^2]$

$= \boxed{.9992}$

4. 12 points (6/part)

Let T^+ = test positive, D = has disease

Told $P(T^+|D) = .99$, $P(T^+|D') = .10$, $P(D) = .01$

a) $P(T^+) = P(T^+ \cap D) + P(T^+ \cap D')$

$= P(D)P(T^+|D) + P(D')P(T^+|D')$

$= (.01)(.99) + (.99)(.1)$

$= .0099 + .0990 = \boxed{.1089}$

b) $P(D|T^+) = \dfrac{P(D \cap T^+)}{P(D)} = \dfrac{P(T^+|D)P(D)}{P(D)} = \dfrac{.0099}{.1089}$

$= \boxed{.0909}$

5. 12 points (3/part)

a) $115/200 = \boxed{57.5\%}$ b) $\frac{75}{100} = \boxed{.75}$

c) $60/85 = \boxed{70.6\%}$

d) $P(\text{hyp. Bord}) \neq P(\text{hyp Bord} | \text{child in school})$

~~20~~ $\boxed{\text{NO}}$

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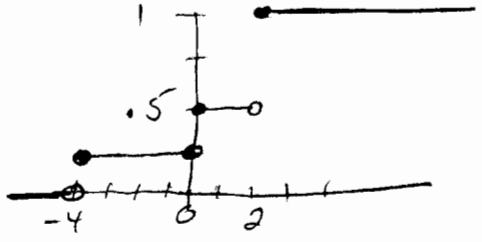
12 points (3/part)

6. a) $k = 1 - .75 = \boxed{.25}$ b) $\mu = (-4)(\frac{1}{4}) + 0(\frac{1}{4}) + 2(\frac{1}{2}) = \boxed{0}$

c) $E(Y^2) = (-4)^2(\frac{1}{4}) + 0^2(\frac{1}{4}) + 2^2(\frac{1}{2}) = 6$ $V(Y) = 6 - 0 = \boxed{6}$

d)

$$F(y) = \begin{cases} 0 & y < -4 \\ .25 & -4 \le y < 0 \\ .5 & 0 \le y < 2 \\ 1 & 2 \le y \end{cases}$$



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10 points

7. Let X be discrete uniform on $0, 1, \ldots, 20$ $E(X) = \frac{20+0}{2} = 10$

$V(X) = \dfrac{(20-0+1)^2 - 1}{12} = \dfrac{440}{12} = \dfrac{110}{3}$. $Y = 590 + (.1)X$ is our r.v.

$E(Y) = E(590 + .1X) = 590 + .1E(X) = 590 + .1(10) = 591$

$V(Y) = V(590 + .1X) = (.1)^2 V(X) = \frac{1}{100}\frac{110}{3} = \frac{110}{300} = \boxed{\frac{11}{30}} = .366$

15 pts (5/part)

8. T_i = order i on time

a) $P(T_1 \cap T_2 \cap T_3) = \prod_{i}^{3} P(T_i) = (.85)^3 = \boxed{.614}$

b) $P([T_1 \cap T_2 \cap T_3'] \cup [T_1 \cap T_2' \cap T_3] \cup [T_1' \cap T_2 \cap T_3])$

$= 3(.85)^2(.15) = \boxed{.325}$

c) P (2 or more not on time)

$= 1 - P$ (fewer than 2 not on time)

$= 1 - P$ (all on time or 1 not on time)

$= 1 - \{P$ (all on time) $+ P$ (exactly 1 not on time)$\}$

$= 1 - [.614 + .325] = \boxed{.061}$