Q6.1

$P(GR|MCP, OP) =$

$\qquad P(GR|LF, RD) * P(LF|MCP) * P(RD|MCP, OP)$

$\qquad + P(GR|\neg LF, RD) * P(\neg LF|MCP) * P(RD|MCP, OP)$

$\qquad + P(GR|LF, \neg RD) * P(LF|MCP) * P(\neg RD|MCP, OP)$

$\qquad + P(GR|\neg LF, \neg RD) * P(\neg LF|MCP) * P(\neg RD|MCP, OP)$

$\qquad = 0.2 * 0.1 * 0.1 + 0.3 * 0.9 * 0.1 + 0.5 * 0.1 * 0.9 + 0.8 * 0.9 * 0.9 = 0.722$

Q6.2

$P(RD|OP) =$

$\quad P(RD|MCP, OP) *$

$\qquad [P(MCP|SF, MF) * P(SF) * P(MF)$

$\qquad + P(MCP|SF, \neg MF) * P(SF) * P(\neg MF)$

$\qquad + P(MCP|\neg SF, MF) * P(\neg SF) * P(MF)$

$\qquad + P(MCP|\neg SF, \neg MF) * P(\neg SF) * P(\neg MF)]$

$\ + P(RD|\neg MCP|OP) *$

$\qquad [P(\neg MCP|SF, MF) * P(SF) * P(MF)$

$\qquad + P(\neg MCP|SF, \neg MF) * P(SF) * P(\neg MF)$

$\qquad + P(\neg MCP|\neg SF, MF) * P(\neg SF) * P(MF)$

$\qquad + P(\neg MCP|\neg SF, \neg MF) * P(\neg SF) * P(\neg MF)]$

$x = P(MCP|SF, MF)$

$P(RD|OP) =$

$0.1 *$

$[x * 0.8 * 0.7$

$+ 0.35 * 0.8 * 0.3$

$+ 0.5 * 0.2 * 0.7$

$+ 0.1 * 0.2 * 0.3]$

$+ 0.6 *$

$[(1 - x) * 0.8 * 0.7$

$+ 0.65 * 0.8 * 0.3$

$+ 0.5 * 0.2 * 0.7$

$+ 0.9 * 0.2 * 0.3]$

$= 0.1[0.56x + 0.16] + 0.6[0.84 - 0.56x]$

$0.31584 = 0.1[0.56x + 0.16] + 0.6[0.84 - 0.56x]$

$x = 0.729143$

Q6.3

For a more detailed explanation on d-separation rules:

http://web.mit.edu/jmn/www/6.034/d-separation.pdf

1. True. GR and SF are d-separated by MCP
2. True. SF's Markov blanket is comprised of its parents (none), its children (MCP), and its children's parents (MF)
3. False. Knowing RD influences P(LF) through P(MCP).
4. False. MCP and OP are not conditionally independent given RD.
   (See d-separation pdf page 3, example 3 for further explanation)
5. False. LF's Markov blanket is comprised of its parents (MCP), its children (GR), and its children's parents (RD)