1.1

P(OR gate | X=1, Z=1)

AND gate			OR gate		
X	Y	Z	X	Y	Z
1	1	1	1	0	1
			1	1	1

$$P(\text{OR gate}) = \frac{2}{3}$$

1.2

$$P(Y=1 \mid X=1, Z=1) = \frac{P(Y=1, X=1, Z=1)}{P(X=1, Z=1)}$$

$$= \frac{2}{3} \text{ (from truth tables)}$$

1.3 When X=1, Z=1 Abduction

P(OR gate) = 2/3 (choosing OR gate)
P(AND gate) = 1/3. (choosing AND gate)

Intervention : X=0

Prediction:

$$Z=0 = (P(OR) * P(Z=0 \mid X=0) + P(AND) * P(Z=0 \mid X=0)]$$

$$= \left(\frac{2}{3} * \frac{1}{2} + \frac{1}{3} * 1\right)$$

$$= (2/3)$$

$$Z=1 = P(OR) * P(Z=1 \mid X=0) + P(AND) * P(Z=1 \mid X=0)$$

$$= \left(\frac{2}{3} * \frac{1}{2} + \frac{1}{3} * 0\right) = 1/3$$

2.2.a

$$PNS = P(Y=1|X=1) - P(Y=1|X=0)$$
$$= 0.9198813 - 0.1992071$$
$$= 0.720.$$

$$PN = \frac{PNS}{P(Y=1|X=1)} = \frac{0.720}{0.919} = 0.783$$

$$PS = \frac{PNS}{P(Y=0|X=0)}$$

$$P(Y=0|X=0) = \frac{P(Y=0, X=0)}{P(X=0)}$$

$$= \frac{0.4}{0.4995}$$

$$PS = \frac{0.720}{0.4} * 0.4995 = 0.8991$$