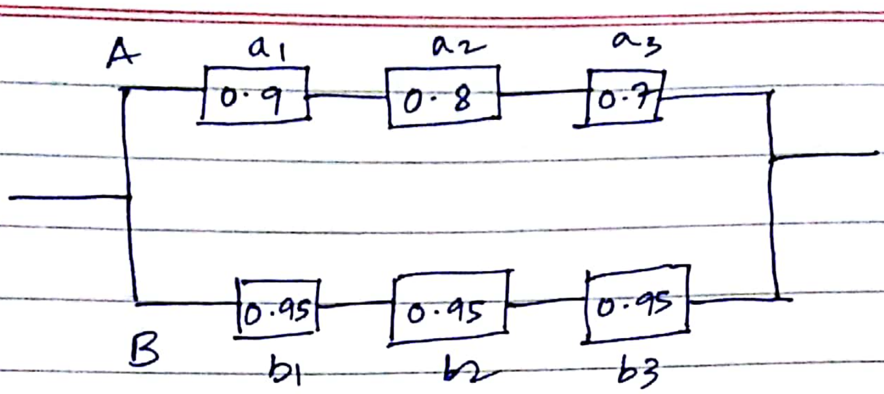
2.156



Let A = Top path,
B = bottom path

A & B are independent

Top path is functional if $a_1 \cap a_2 \cap a_3$ occurs.

Bottom path is functional if $b_1 \cap b_2 \cap b_3$ occurs.

~~P(A∪B~~

The circuit is functional iff $A \cup B$ occurs

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

By independence,

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

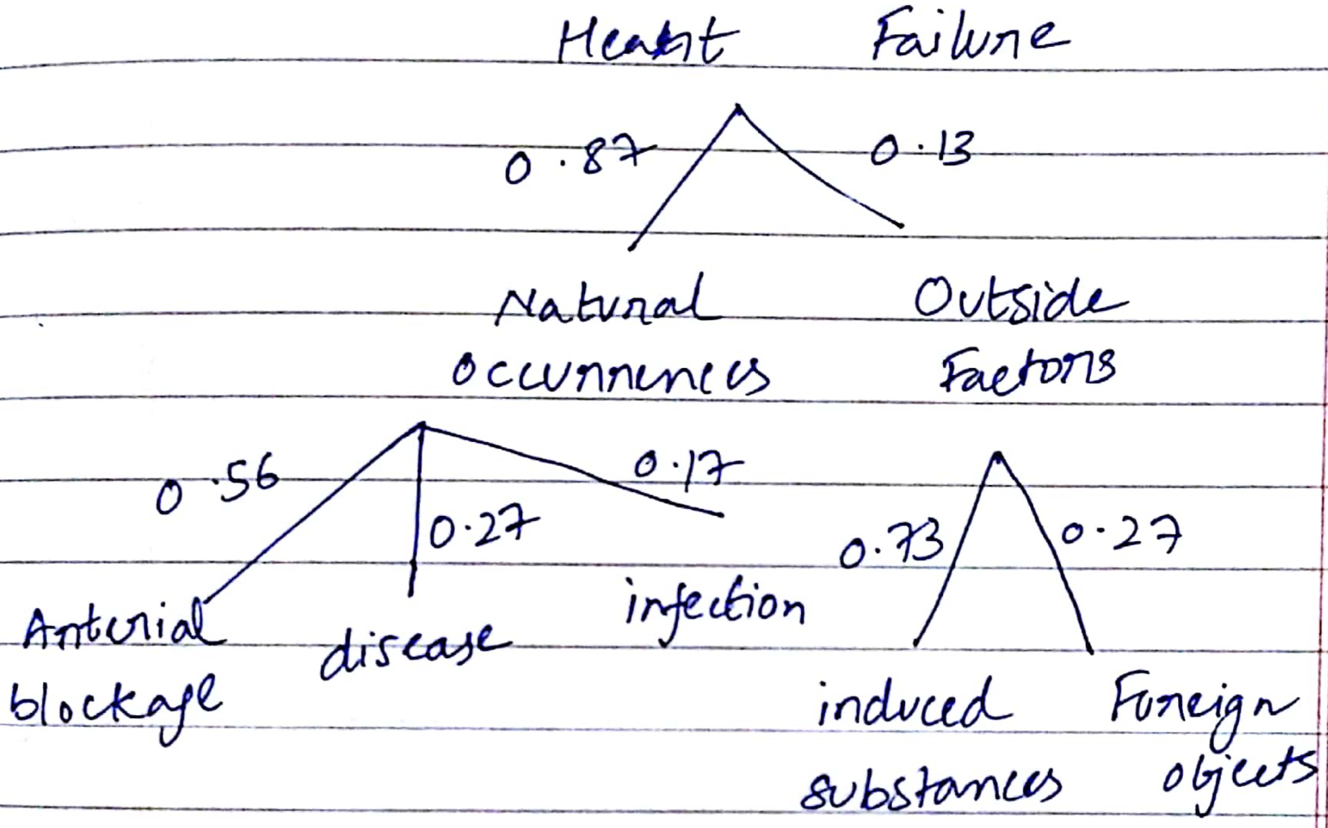
$$= (0.9)(0.8)(0.7) + (0.95)(0.95)(0.95) - (0.9)(0.8)(0.7)(0.95)^3$$

$$= 0.504 + 0.857 - 0.432 = 0.929$$

The probability that the circuit operates is 0.929.

2.128

Using tree diagram



a) P(failure due to induced substance) $= (0.13)(0.73)$

$= 0.0949$

b) P(failure due to disease or infection)

$= 0.87(0.27) + 0.87(0.17)$

$= 0.382$

2.102

Total = 100 parts

		Length Excellent	Length Good
Surface finish	Excellent	80	2
	Good	10	8

A = sample has excellent finish

B = sample has excellent length

a) $P(A) = \frac{80+2}{100} = \frac{82}{100} = 0.82$

b) $P(B) = \frac{80+10}{100} = \frac{90}{100} = 0.90$

c) $P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{80}{80+10} = 0.88$

d) $P(B|A) = \frac{P(B \text{ and } A)}{P(A)} = \frac{80}{80+2} = 0.975$

e) $P(B|\cancel{A}) = 0.975$

f) $P(A|B') = \frac{P(A \text{ and } B')}{P(B')} = \frac{2}{2+8} = \frac{2}{10} = 0.20$

Scanned by CamScanner

2.172

I = identifying a defective item
D = defective item is chosen

$P(D) = 0.009$ $\quad P(I|D) = 0.99$

$P(D') = 0.991$ $\quad P(I|D') = 0.005$

$P(I'|D) = 0.995$

a)

$$P(I) = P(I|D)\,P(D) + P(I|D')\,P(D')$$

$$= 0.99(0.009) + (0.005)(0.991)$$

$$= 0.0139$$

The probability that an item selected for inspection is classified as defective is 0.0139.

b)

$$P(D|I') = \frac{P(D \cap I')}{P(I')} = \frac{P(I'|D)P(D)}{P(I')}$$

$$= \frac{(0.995)(0.991)}{(1-0.0139)} = 0.9999$$

3.103.

X= No. of mornings with green lights as you approach it

Using binomial distribution,

$p=0.2 \quad q=0.8$

a)

PMF of x is $f(x) = P(X=x)$

$$P(X=1) = {}^{5}C_{1} (0.2)^{1} (0.8)^{9}$$

$$= 0.4096$$

b) $P(X=4) = {}^{20}C_{4} (0.2)^{4} (0.8)^{16}$

$$= 4845 (0.0016)(0.02814)$$

$$= 0.2181$$

c) $P(X>4) = 1 - P(X \le 4) = 1 - [P(X=0) + P(X=1) + P(X=2) + P(X=3) + P(X=4)]$

$$= 1 - [0.011 + 0.057 + 0.1369 + 0.2053 + 0.2181]$$

$$= 0.3717$$

3.66

x = Nickel charge

x	$f(x)$	$x - 2.29$	$(x-2.29)^2$	$(x-2.29)^2 f(x)$
0	0.17	-2.29	5.244	0.891
2	0.35	-0.29	0.084	0.029
3	0.33	0.71	0.504	0.166
4	0.15	1.7	2.92	0.438
				1.524

CDF

$$F(x) = \begin{cases} 0 & x<0 \\ 0.17 & 0 \le x < 2 \\ 0.52 & 2 \le x < 3 \\ 0.85 & 3 \le x < 4 \\ 1 & x \ge 4 \end{cases}$$

Mean $= \sum x f(x) = 2.29$

Variance $= \cancel{\sum x^2 f(x) - \mu}$

$$\sum_{i=1}^{4} f(x_i)\,(x_i - \mu)^2$$

$$= 1.524$$

3.101 x = No. of times the line is occupied

binomial distribution

$n=10 \quad p=0.4 \quad q=0.6$

a) $P(x=3) = {}^{10}C_3 (0.4)^3 (0.6)^7 = 120(0.064)(0.027)$

$= 0.2149$

b) $P(x \geq 1) = 1 - P(x<1) = 1 - P(X=0)$

$= 1 - [{}^{10}C_0 (0.4)^0 (0.6)^{10}] = 1 - [(0.6)^{10}]$

$= 0.994$

c) $E(x) = np = 10(0.4) = 4$