EE2 Mathematics – Probability & Statistics

Exercise 2

1. The table below gives the number of components in boxes A, B and C, and how many of these components are defective in each one.

Box	A	B	C
No. of components in box	150	100	50
No. of defectives in box	15	5	5

   A box is chosen at random; a component is then chosen at random from that box. What is the probability that the chosen component is defective? *Hint: Let D be the event the component is defective and then use the law of total probability to calculate the required probability $P(D)$.*

2. In use, a component may encounter one of two environments. A normal environment is met with probability 0.99 and a severe one with probability 0.01. In a normal environment the probability of a component failing is 0.02, whereas in a severe one this probability is 0.50. Find (a) the probability of failure; (b) given that a component fails, the probability that it encountered a severe environment.

3. A device for detecting mineral deposits contains two sensors A and B which fail with probabilities 0.04 and 0.12 respectively. These two sensors cannot both be in their failure state.

   Construct a probability table for this situation and then determine: (a) the probability that sensor A works given that sensor B is working and (b) the probability that sensor B works given that sensor A is working.

4. A machine that requires annual safety checks is reaching the end of its useful life. Let A be the event "the machine is safe" and B be the event "the inspector issues a safety certificate". If $P(A) = 0.85$, $P(B) = 0.8$, and $P(\overline{A} \cap \overline{B}) = 0.12$, then

   (a) determine $P(A \cap B)$;

   (b) determine $P\left[(A \cap B) \cup (\overline{A} \cap \overline{B})\right]$;

   (c) given that the machine is unsafe, what is the probability that the inspector issues a safety certificate?

Answers: 1. $\frac{1}{12}$ 2. (a) 0.0248 (b) 0.2016 3. (a) 0.955 (b) 0.875 4. (a) 0.77 (b) 0.89 (c) 0.2