WIIT 7751

Lesson F Guided Notes

Experiment:

Sample Space:

- An experiment consists of rolling a six-sided die and recording whether an even number or an odd number comes up. What is the sample space of this experiment?

- An experiment consists of flipping a coin twice. What is the sample space of this experiment?

Events: any subset of outcomes in the sample space of an experiment.

- A simple event is an event that consists of only one outcome
- A compound event is an event that consists of more than one outcome
- An event can be represented by a capital letter (A, B, etc.), or by a letter with a subscript (E_1, E_2, E_3, etc.)
- An event A is said to occur if the outcome of an experiment is contained in A.

If we roll a six-sided die, what is the sample space?

Example 1: Suppose a quality team member is testing whether or not ball bearings are within the allowable tolerance range for the measured diameter. Each ball bearing will either succeed to be in the tolerance range (S) or fail to be within the tolerance range (F). Suppose ball bearings are selected at random until one fails to be within the tolerance range.

a) What is the sample space for this experiment?

b) If we consider the event A = a failure occurs in the first five samples, we can write it as

c) If the outcome of SF is observed, would we say event A occurred?

d) If the outcome SSSSSSSSSF is observed, would we say event A occurred?

Set Theory Relations

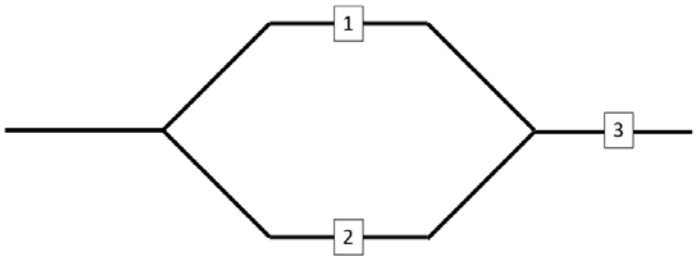
The compliment of an event A, denoted by A', is the set of all outcomes in $\mathcal{S}$ that are not contained in A.

The union of two events A and B, denoted by A ∪ B, read as "A or B" is the event consisting of all outcomes that are either in A or in B or in both events.

The intersection of two events A and B, denoted by A ∩ B, read "A and B", is the event consisting of all outcomes that are in both A and B.

When A ∩ B = ____, A and B are said to be mutually exclusive or disjoint events.

Example 2: Three components are connected to form a system as shown in the accompanying diagram. Because the components in the 1–2 subsystem are connected in parallel, that subsystem will function if at least one of the two individual components functions. For the entire system to function, component 3 must function and so must the 1–2 subsystem.

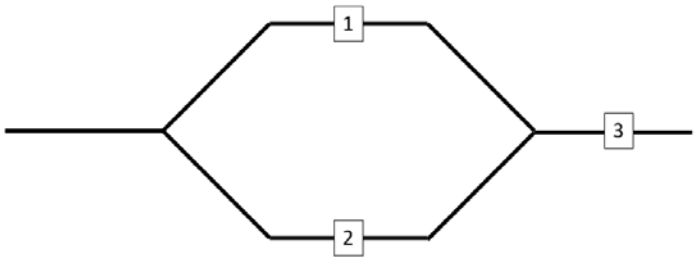


Let's denote a component functioning by *S* and a component not functioning by *F,* and let the position refer to the corresponding component number. So, for example, *SFF* refers to the first component functioning and the second and third components not functioning.

(a) Which outcomes are contained in the event A that exactly two of the three components function?

(b) Which outcomes are contained in the event B that at least two of the components function?

(c) Which outcomes are contained in the event C that the system functions?



(d) List the outcomes in C', C complement.

(e) List the outcomes in $A \cup C$, A union C.

(f) List the outcomes in $A \cap C$, A intersect C.

(g) List the outcomes in $B \cup C$, B union C.

(h) List the outcomes in $B \cap C$, B intersect C.