EE 503

Lecture Notes Part 7

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7.0 Combined Experiments

We can view several experiments as one combined experiment.

Example: Roll a fair die and then toss a fair coin. Observe the outcomes.

$$\Omega_1 = \{1, 2, 3, 4, 5, 6\}, \quad \Omega_2 = \{H, T\}.$$

Combination is

$$\Omega = \{1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T\}.$$

Notation:

$$\Omega = \Omega_1 \times \Omega_2 = \{\omega_1\omega_2 : \omega_1 \in \Omega_1, \omega_2 \in \Omega_2\}.$$

Definition: The *cartesian product* $\Omega_1 \times \Omega_2 \times \cdots \times \Omega_n$ is the set of all n-tuples $\{\omega_1\omega_2 \cdots \omega_n\}$ such that $\omega_k \in \Omega_k,\ k = 1, 2, \ldots, n$.

Note: Often the events $\omega_1 \in \Omega_1$ and $\omega_2 \in \Omega_2$ are independent so that $P(\omega_1\omega_2) = P(\omega_1)P(\omega_2)$. For example, if we toss a fair coin twice we get independent events. If we view the two tosses as one experiment then $\Omega = \{HH, HT, TH, TT\}$ and $P(HT) = P_1(H)P_2(T)$. Observe we have distinguished the probability measures since we have different probability spaces involved.