Section 2.2: Calculating Probabilities

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Some properties of probabilities:

$P(A)$ is a real number between 0 and 1 inclusive

$$0 \leq P(A) \leq 1$$

$$\sum P(A_i) = 1$$

Complements

$\bar{A}$ "not A" – the event in which A did not happen

note: also written as A^c, A', $\sim A$, $\neg A$

$$P(\bar{A}) = 1 - P(A)$$

Rule of products (combinatorics):

step 2

$$n_{tot} = n_1 \times n_2 \times n_3 \times \dots \times n_k$$

n_{tot}: total number

n_1: number of

n_k: last

total number of events

number of ways step 1 can happen

last step

example: How many 5-digit, case-sensitive, alphanumeric passwords are there

a) in total?
b) that contain at least one number and one letter?

a) alphanumeric = letters and numbers
case-sensitive = lowercase and uppercase

total characters possible = $26 + 26 + 10 = 62$

$$\#\text{passwords} = \underline{62}\ \underline{62}\ \underline{62}\ \underline{62}\ \underline{62} = 62^5$$
$$= 916\ 132\ 832$$

b) total allowed = total possible − forbidden

all numbers: 10^5
all letters: 52^5

total allowed = $62^5 - 52^5 - 10^5$

$= 535,828,000$