Section 6.3: Probability

Thursday, November 27, 2014
8:30 AM

classical probability: if all outcomes are equally likely, then the probability of event E happening is:

number of ways E can happen

$$P(E) = \frac{n(E)}{n}$$

total number of outcomes

probability of E happening

all rolls are equally likely

example: If you roll two fair 4-sided dice, what is the probability that the sum of the rolls is 3 or less?

brute force method:

11	12	13	14
21	22	23	24
31	32	33	34
41	42	43	44

$$P(\text{sum} \le 3) = \frac{n(\text{sum} \le 3)}{n}$$

$$= \frac{3}{16}$$

At the Red Barn Market, you can get an icecream cone with two scoops of ice-cream. Assuming that you choose two different flavors for your scoops, that you don't care which one goes on top, and that when averaged over all customers, each flavor is equally likely to be chosen, compute the following probabilities.

The flavors are: spumoni, hazelnut, moosetracks, tiger tiger

a) How many different ice cream cones are possible? If a random customer makes an order, what probability does a particular cone have to be picked?

flavors: S H M T

SH SM ST

HM HT

MT

or $_4C_2$

Sample space

cones = 6

$$P(\text{a particular cone}) = \frac{1}{6}$$

b) what is the probability that a random customer will order spumoni as one of the two scoops?

$$P(\text{spumoni}) = \frac{n(\text{spumoni})}{n}$$

$$= \frac{3}{6} = \boxed{\frac{1}{2} \text{ or } 50\%}$$

c) what's the probability that a random customer will order both moose tracks and hazelnut?

$$P(MH) = \frac{n(MH)}{n} = \frac{1}{6}$$

d) what's the probability that a random customer will order moosetracks or hazelnut or both?

$$P(M \text{ or } H) = \frac{n(M \text{ or } H)}{n} = \frac{5}{6}$$

e) calculate (d) again using a different method

$$P(M \text{ or } H) = P(M) + P(H) - P(MH)$$

$$= \frac{1}{2} + \frac{1}{2} - \frac{1}{6}$$

$$= 5/6$$

f) calculate (d) again using yet <u>another</u> method

$$P(M \text{ or } H) = 1 - P(\overline{M \text{ or } H})$$

$$= 1 - P(ST)$$

$$= 1 - 1/6$$

$$= 5/6$$

or just 1

note: $P(E) = 100\% - P(\overline{E})$

for classical probability it is assumed that all outcomes are equally likely

in real life, this is frequently not true

$\rightarrow$ contingency table

from handout:

1) $P(T) = \frac{n(T)}{n} = \frac{50}{100} = \boxed{\frac{1}{2} \text{ or } 50\%}$

2) $P(MB) = \frac{n(MB)}{n} = \frac{25}{100} = \boxed{\frac{1}{4} \text{ or } 25\%}$

3) $P(M \text{ or } B) = \frac{n(M \text{ or } B)}{n}$

$= \frac{45 + 25 + 25}{100} = 95\% \text{ or } \frac{19}{20}$

or

$P(M \text{ or } B) = 1 - P(FT)$

$= 1 - 5/100$

$= 95\%$

or

$P(M \text{ or } B) = P(M) + P(B) - P(MB)$

$= \frac{70}{100} + \frac{50}{100} - \frac{25}{100}$

$= 95\%$

new notation:

$$P(A \mid B) \equiv \text{probability of } A \text{ happening if } B \text{ has already occured}$$

(if)

$$P(B \mid A) \equiv \text{probility of } B \text{ happening if } A \text{ has happened}$$

$P(T \mid F)$: probability of being a tech student if you only look at the female population

$P(F \mid T)$: probability of being female if you are a tech student

$$P(A \mid B) = \frac{n(AB)}{n(B)}$$

same