

Chp 10 Introducing Probability

∴ chance behavior is unpredictable in the short run, but has a regular/predictable pattern in long run.

Vocab: random ⇒ a phenomenon is random if individual outcomes are uncertain but there is regular distribution of outcomes in large # of repetitions.
probability of an outcome = proportion of times outcome would occur in a very long series of repetitions

sample space S: set of all possible outcomes
event: subset of sample space (usually denoted by capital letter)

Probability model:
① a sample space
② a way of assigning probabilities to events

disjoint events that have no outcomes in common

Probability Rules

- ① $0 \leq P(A) \leq 1$
- ② $P(S) = 1$
- ③ $P(A \text{ or } B) = P(A) + P(B)$ if $A \nsubseteq B$ disjoint
- ④ $P(A \text{ does not occur}) = 1 - P(A)$
ie. $P(\bar{A}) = 1 - P(A)$

(a) discrete prob. model: finite sample space

(b) continuous prob. model: continuous sample space

(to find these probabilities, you'd find area under density curve)

random variable: variable whose value is numerical outcome of random phenomenon

Chp 10 (cont)

Ex 1 Match these probabilities to the statements.

0

(a) event is impossible

0.01

(b) event is certain (it occurs on every try)

0.3

(c) event is unlikely, but will occur sometimes

0.6

0.99

(d) event will occur frequently.

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Ex 2 Choose a student at random. Describe sample space S for each of these: (discrete or continuous)

(a) Is student male or female?

(b) Student's height (in inches)?

(c) How much money (in cents) student has with him/her?

(d) Student's letter grade for this course

Chp 10 (cont)

Ex 3 ^(a) Roll a b -sided die twice. What is sample space?

(b) Assign probabilities to each outcome.

Chp 10 (cont)

Ex 4 Choose an American adult at random.

Define two events: $A =$ person is obese

$B =$ person is overweight, but not obese

According to NCHS (Natl Ctr for Health Stats),

$$P(A) = 0.32 \quad \& \quad P(B) = 0.34.$$

(a) Are A & B disjoint? why or why not?

(b) What is $P(A \text{ or } B)$?

(c) $P(C) = ?$ If $C =$ person has normal weight

Chp 10 (cont)

Ex 5 which are legitimate probability models for an unfair die? why?

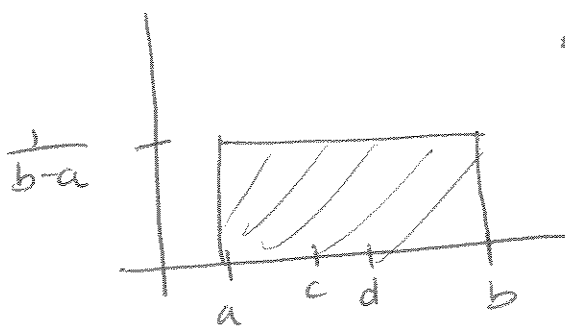
outcome	model 1	model 2	model 3	model 4
1	$\frac{1}{7}$	$\frac{1}{3}$	$\frac{1}{3}$	1
2	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{6}$	1
3	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{6}$	2
4	$\frac{1}{7}$	0	$\frac{1}{6}$	1
5	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{6}$	1
6	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{6}$	2

For model 2, what is $P(A)$, if $A = \text{roll a \# at least 3 or more}$

uniform distribution (everything is equally likely)

density curve

- area between $x=a$ and $x=b$ is 1.
- height is same everywhere
- $P(c \leq X \leq d) = \text{area under curve between } x=c \text{ + } x=d.$



$$\text{Area} = 1 = (b-a)y \Rightarrow y = \frac{1}{b-a}$$

Chp 10 (cont)

EX 6 Grade distribution

X	E	D	C	B	A
P(X)	0.02	0.1	0.2	0.42	0.26

(a) Is this a probability model?

(b) What is $P(X \geq B)$?
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meant by

(c) Write this event "student got grade below C" in terms of rv X , (random variable).
What is probability of this event?

Tidbits

- normal distributions are continuous prob. models
- in all continuous prob. models, $P(X=k) = 0$, i.e. probability of one particular value is zero
- personal probability = a person's opinion/feeling of the likelihood of something happening (still must obey rules of probability)