MATH 210 FINITE MATHEMATICS

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7.2 Probability

Definition 1: Relative Frequency

Suppose we repeat an experiment n times and an event E occurs m times. The relative frequency of E is

$$\frac{m}{n}$$

Definition 2: Simple Event

EVENT WITH ONLY ONE OUTCOME

Example 1

NIU was surveyed and the following info was found:

	Undecided	Liberal Arts	Health	Business	Total
Upper-classmen	12	46	24	88	170
Lower-classmen	60	15	7	8	110
Total	72	61	31	116	280

If one NIU student is selected at random, what is the probability that

1. an upper-classmen is selected? $\frac{170}{280} = \frac{17}{28}$
2. an undecided lower-classmen is selected? $\frac{60}{280} = \frac{3}{14}$
3. a liberal arts student is selected? $\frac{61}{280}$

Definition 3: Probability Distribution

A table that lists the probability of each simple event

1. Probability Function $P(s_i)$ $P(S_i)$
2. $P(S_1)+P(S_2)+\cdots+P(S_n)=1$
3. $P(S_1 \cup S_2)=P(S_1)+P(S_2)$
4. ~~[illegible]~~ $0 \le P(S_i) \le 1$

Probability Distrubtion

Simple Event	Probability
$\{S_1\}$	$P(S_1)$
S_2	$P(S_2)$
S_3	$P(S_3)$
S_4	$P(S_4)$
$\vdots$	$\vdots$
S_n	$P(S_n)$

Definition 4: Uniform Sample Space

EACH SIMPLE EVENT HAS THE SAME PROBABILITY

Example 2: Rolling One Die

Suppose you roll one die and record the number.

1. What is the sample space? $\{1, 2, 3, 4, 5, 6\}$

2. List all simple events $\{1\}, \{2\}, \{3\}, \{4\}, \{5\}$ $\{6\}$

3. What is the probability of each simple event?

$P(1)=\frac{1}{6}$, $P(2)=\frac{1}{6}$, ... $P(\#)=\frac{1}{6}$

4. Find the probability distribution

Probability Distrubtion

Simple Event	Probability
1	1/6
2	1/6
3	1/6
4	1/6
5	1/6
6	1/6

↖ TOTAL $=\frac{6}{6}=1$

5. What is the probability of rolling an odd?

$P(\text{ODD})=P(1 \text{ OR } 3 \text{ OR } 5)=$

$=P(1)+P(3)+P(5)$

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

Example 3

A group of people were asked to name their favorite class.

Class	Math	English	Sociology	Music	Economics
Frequency	56	13	21	14	15

TOTAL: 119

1. Find the probability distribution

OUTCOME	PROBABILITY
MATH	$\frac{56}{119} \approx .47$
ENGLISH	$\frac{13}{119} \approx .11$
SOCIOLOGY	$\frac{21}{119} \approx .18$
MUSIC	$\frac{14}{119} \approx .12$
ECON	$\frac{15}{119} \approx .13$

OFF BECAUSE OF ROUNDING

2. Is this a uniform sample space?

NO

3. What is the probability that a student selected randomly has English or Music as their favorite class?

$$P(E \text{ OR } M) = P(E) + P(M)$$
$$= .11 + .12$$
$$= .23$$