

# Discussion 8

CUNY MSDS DATA 605

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**Book:** Grinstead: Introduction to Probability

### Exercise

Consider the following two experiments: the first has outcome  $X$  taking on the values 0, 1, and 2 with equal probabilities; the second results in an (in-dependent) outcome  $Y$  taking on the value 3 with probability  $1/4$  and 4 with probability  $3/4$ . Find the distribution of:

### Solution

Outcome	Probability
0	0.3333333333333333
1	0.3333333333333333
2	0.3333333333333333

Table 1: Probability Table for Outcome  $X$ .

Outcome	Probability
3	0.25
4	0.75

Table 2: Probability Table for Outcome  $Y$ .

a)  $Y + X$ .

Operation	Result	Convolutd	Probability
$3 + 0$	3	$0.25 \times 0.3333333333333333$	0.0833
$4 + 0$	4	$0.75 \times 0.3333333333333333$	0.2500
$3 + 1$	4	$0.25 \times 0.3333333333333333$	0.0833
$4 + 1$	5	$0.75 \times 0.3333333333333333$	0.2500
$3 + 2$	5	$0.25 \times 0.3333333333333333$	0.0833
$4 + 2$	6	$0.75 \times 0.3333333333333333$	0.2500

Table 3: Probability Table of individual Outcomes  $S_n = Y + X$ .

From the above table, we can deduct that our possible outcomes for  $S_n$  are as follows:  $S_n = \{3, 4, 5, 6\}$ .

From here we can deduct our probabilities as follows:

Sn	Probability	Percentage
3	0.0833	8.33 %
4	0.3333	33.33 %
5	0.3333	33.33 %
6	0.2500	25 %

Table 4: Probability Table for Unique Outcomes  $S_n = Y + X$ .

**b)  $Y - X$ .**

Operation	Result	Convolutd	Probability
3 - 0	3	$0.25 \times 0.3333333333333333$	0.0833
4 - 0	4	$0.75 \times 0.3333333333333333$	0.2500
3 - 1	2	$0.25 \times 0.3333333333333333$	0.0833
4 - 1	3	$0.75 \times 0.3333333333333333$	0.2500
3 - 2	1	$0.25 \times 0.3333333333333333$	0.0833
4 - 2	2	$0.75 \times 0.3333333333333333$	0.2500

Table 5: Probability Table of individual Outcomes  $S_n = Y - X$ .

From the above table, we can deduct that our possible outcomes for  $S_n$  are as follows:  $S_n = \{1, 2, 3, 4\}$ .

From here we can deduct our probabilities as follows:

Sn	Probability	Percentage
1	0.0833	8.33 %
2	0.3333	33.33 %
3	0.3333	33.33 %
4	0.2500	25 %

Table 6: Probability Table for Unique Outcomes  $S_n = Y - X$ .

Let me know what you think.