Exercise Set-1

Q1. A Random Variable x has following probability distribution:

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2$+k

Find: 1. k

2. $P(x < 6), P(x \geq 6), P(0 < x \ < 5)$

3. Probability distribution

4. if $(P \ \leq c\ ) > \frac{1}{2}$. Find the min value of c

5. Find $P\left(\frac{1.5 < x < 4.5}{x > 2}\right)$

Exercise Set-2

Finding out a patient's probability of having liver disease if they are an alcoholic. "Being an alcoholic" is the test (kind of like a litmus test) for liver disease.

A: The event "Patient has liver disease." Past data tells you that 10% of patients entering your clinic have liver disease.

B: The litmus test that "Patient is an alcoholic." Five percent of the clinic's patients are alcoholics.

You might also know that among those patients diagnosed with liver disease, 7% are alcoholics.

Exercise Set-3

- In clinic, 10% of patients are prescribed narcotic pain killers.
- Overall, 5% of the clinic’s patients are addicted to narcotics (including pain killers and illegal substances).
- Out of all the people prescribed pain pills, 8% are addicts.
- If a patient is an addict, what is the probability that they will be prescribed pain pills?

Exercise Set-4

- You are a financial analyst at an investment bank.
- According to your research of publicly-traded companies, 60% of the companies that increased their share price by more than 5% in the last three years replaced their CEOs during the period.
- At the same time, only 35% of the companies that did not increase their share price by more than 5% in the same period replaced their CEOs.
- Knowing that the probability that the stock prices grow by more than 5% is 4%, find the probability that the shares of a company that fires its CEO will increase by more than 5%.

Bayes' theorem is when event A is a binary variable.

- In such a case, the theorem is expressed in the following way:

$$P(A^+/B) = \frac{P(B/A^+)\,P(A^+)}{P(B/A^-)P(A^-) + P(B/A^+)P(A^+)}$$

where:

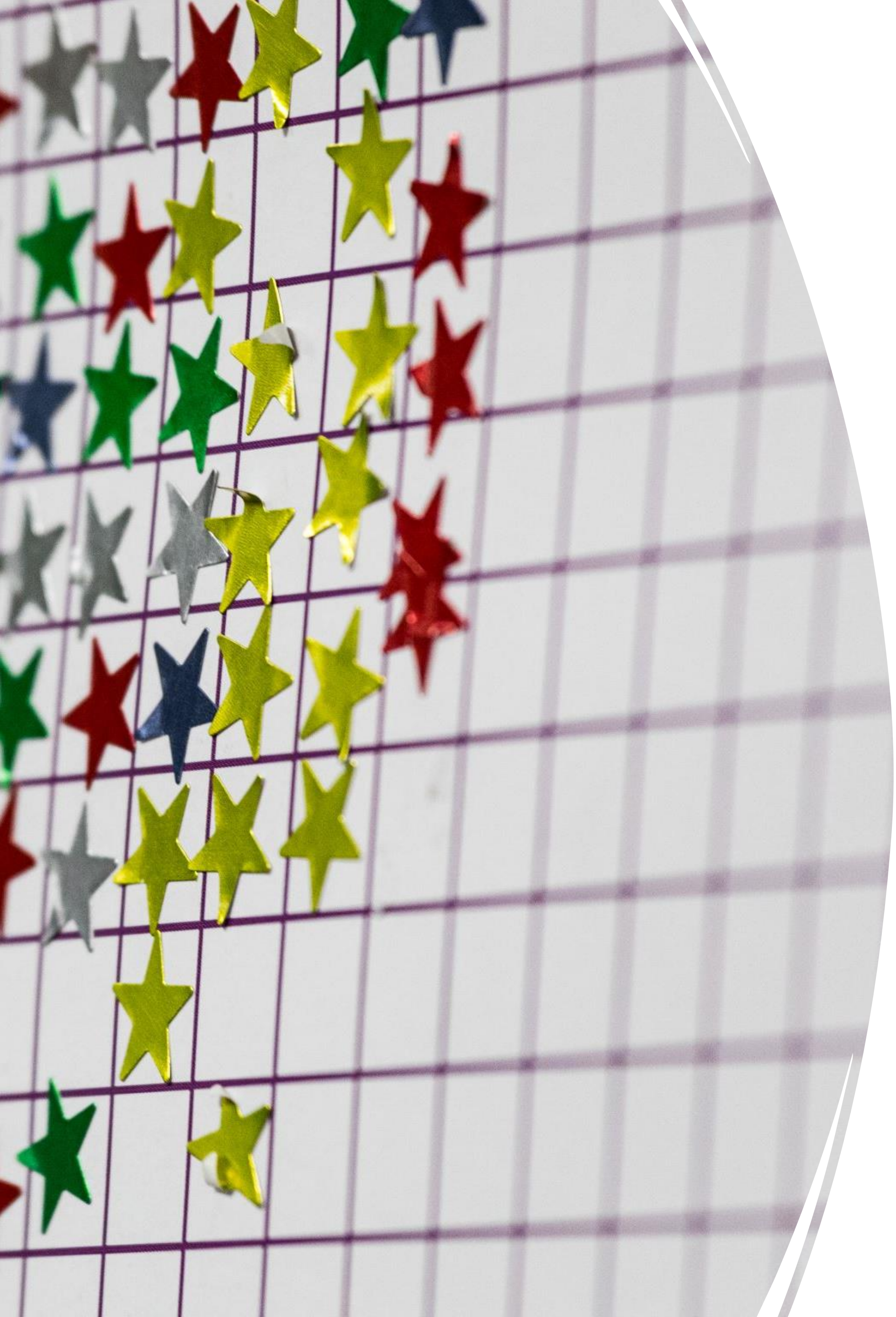
- P(B| A^-): the probability of event B occurring given that event A^- has occurred
- P(B| A^+) – the probability of event B occurring given that event A^+ has occurred
- In the special case above, events A^- and A^+ are mutually exclusive (Mutually exclusive is a statistical term describing two or more events that cannot happen simultaneously) outcomes of event A.

Mutually exclusive event:

- Two events are mutually exclusive when they cannot occur at the same time.
- For example, if we flip a coin it can only show a head OR a tail, not both.

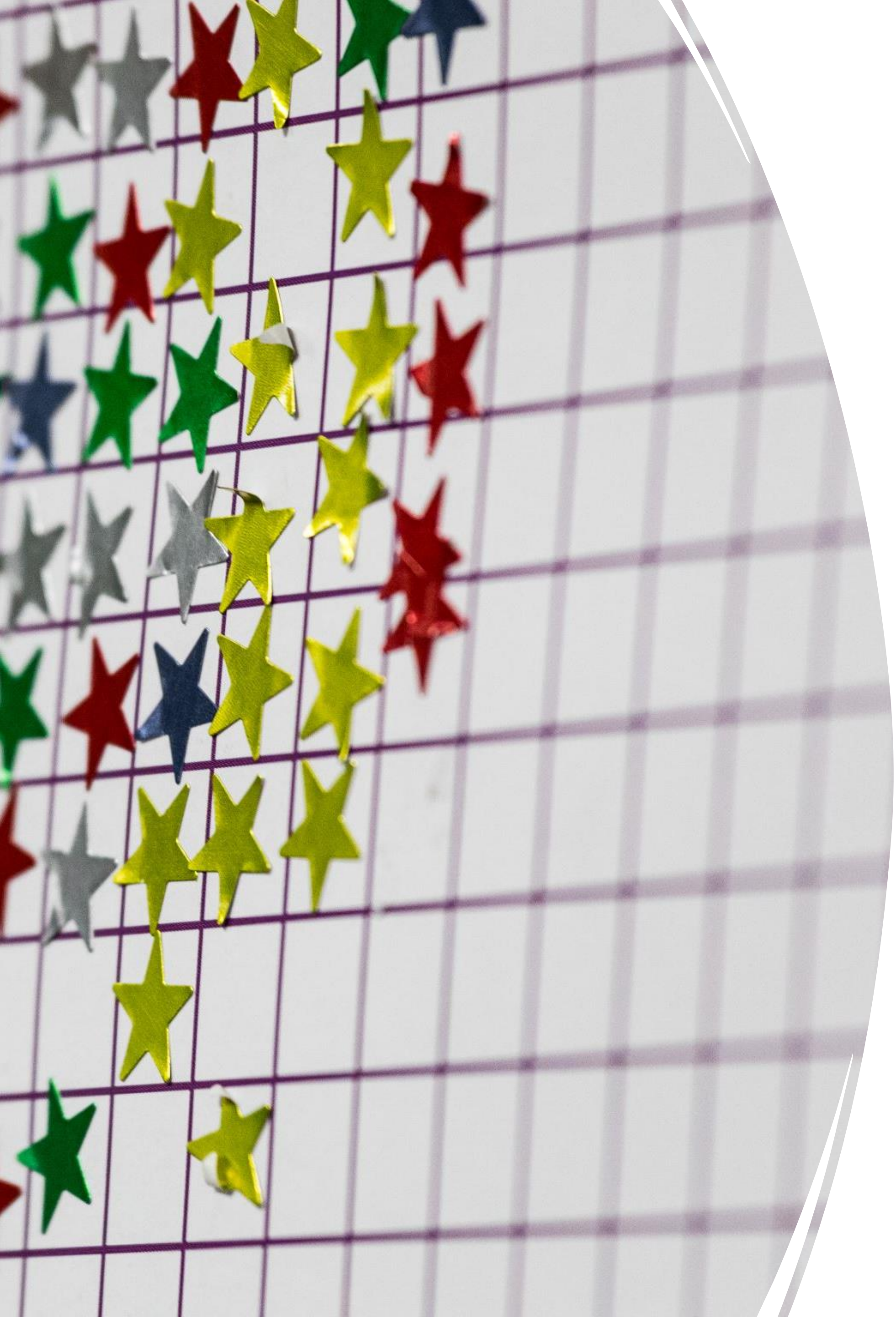
Independent event:

- The occurrence of one event does not affect the occurrence of the others.
- For example, if we flip a coin two times, the first time may show a head, but the next time when we flip the coin the outcome will be heads also.
- From this example, we can see the first event does not affect the occurrence of the next event.



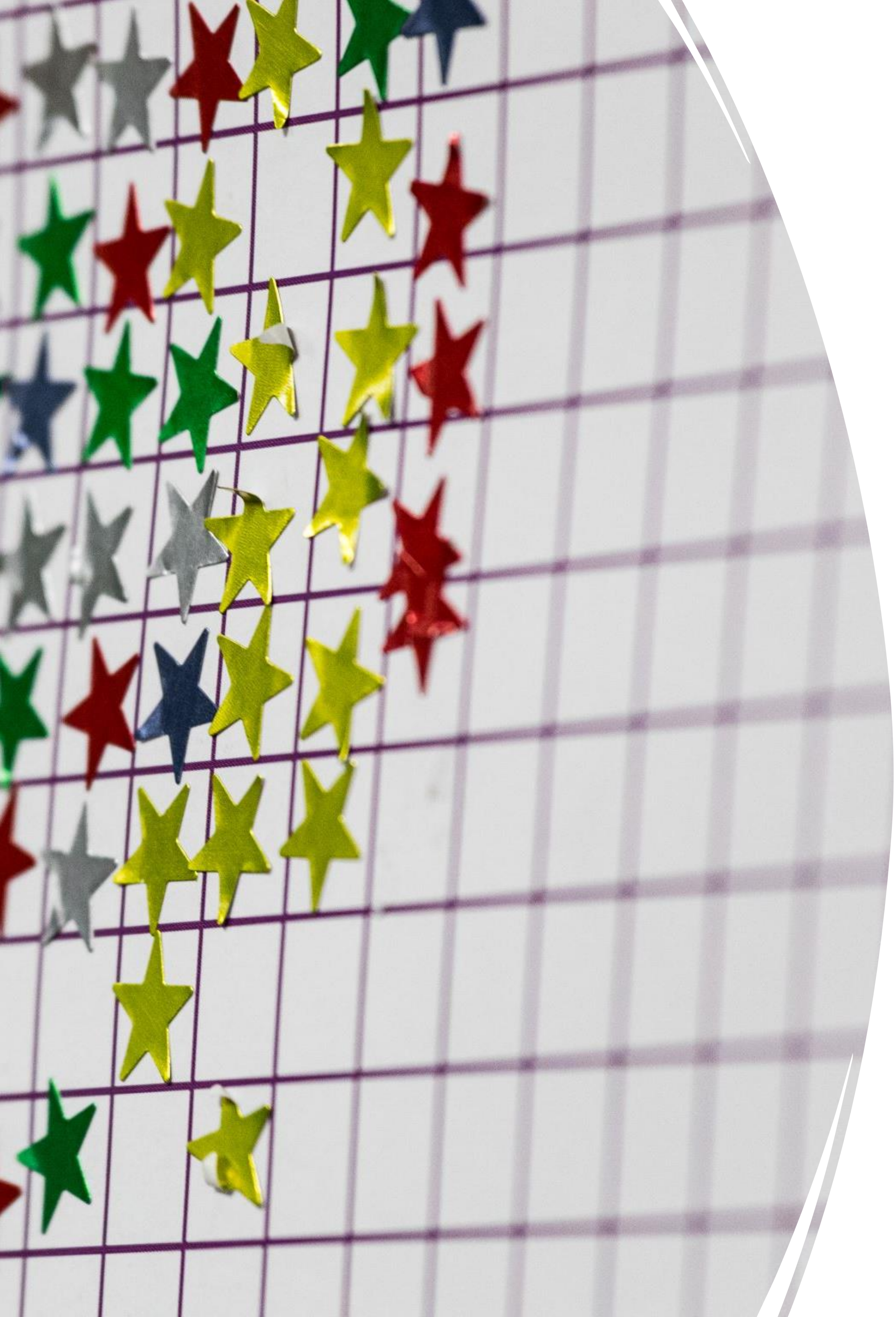
Exercise Set-5

- Let *X* equal the number of siblings of BU students. The support of *X* is, of course, 0, 1, 2, 3, ...
- Because the support contains a countably infinite number of possible values, X is a discrete random variable with a probability mass function.
- Find f(x)=P(X=x), the probability mass function of X, for all x in the support.



Exercise Set-6

- Let $f(x) = cx^2$ for x=1,2,3.
- Determine the constant c so that the function $f(x)$ satisfies the conditions of being a probability mass function.



Exercise Set-7

- Determine the constant c so that the following p.m.f. of the random variable y is a valid probability mass function:

$$f(y) = c\left(\frac{1}{4}\right)^{y} \quad for\ y = 1, 2, 3, \ldots$$