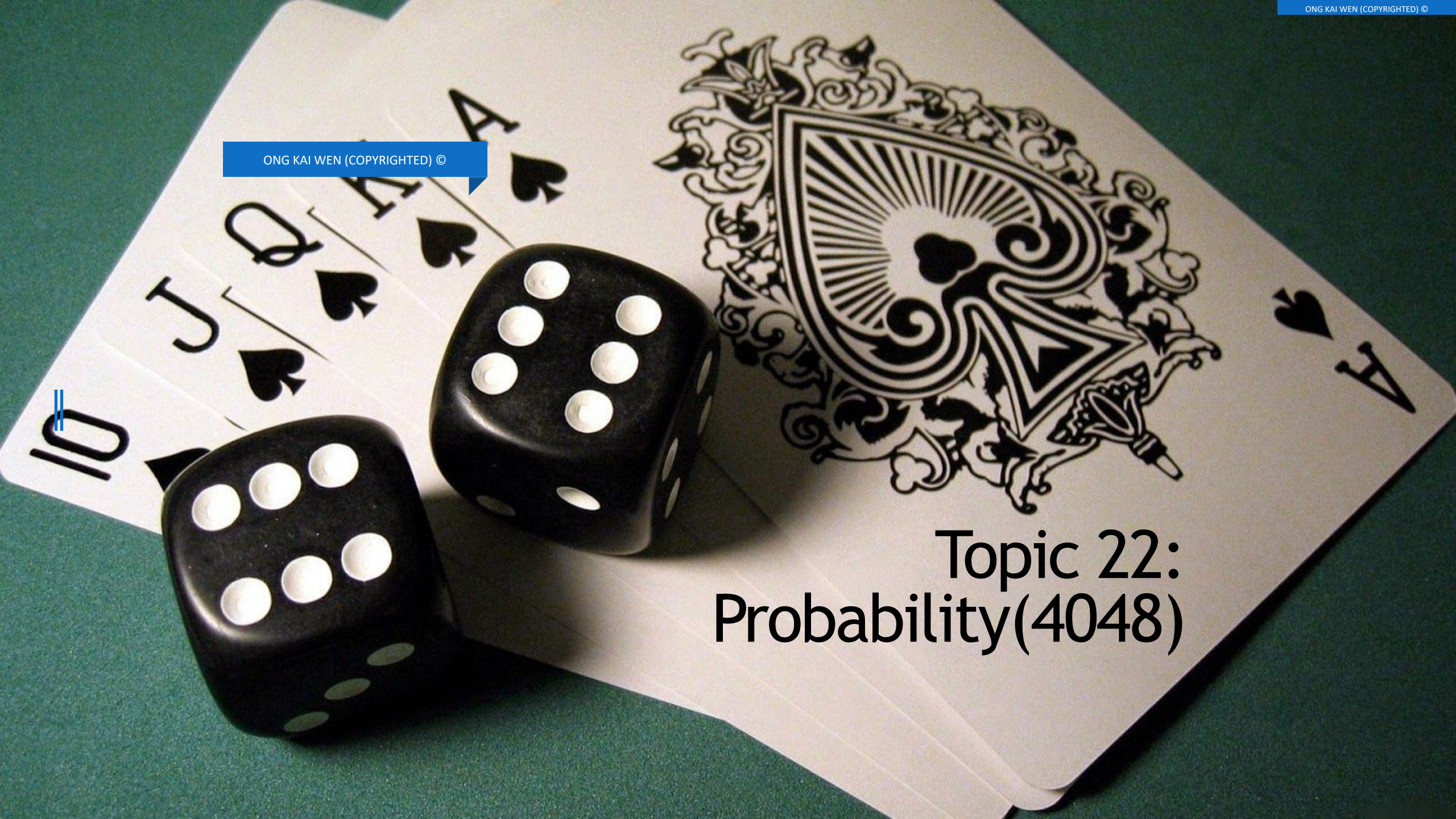

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Topic 22: Probability(4048)

THE ABOUT

CHAPTER ANALYSIS

MASTERY

- Conceptually simple chapter, but can be deceivingly difficult and complicated
- 3 **key** concepts

EXAM

- Concepts usually tested as a stand-alone topic
- Easy to make careless mistakes if not careful i.e. under/double counting

WEIGHTAGE

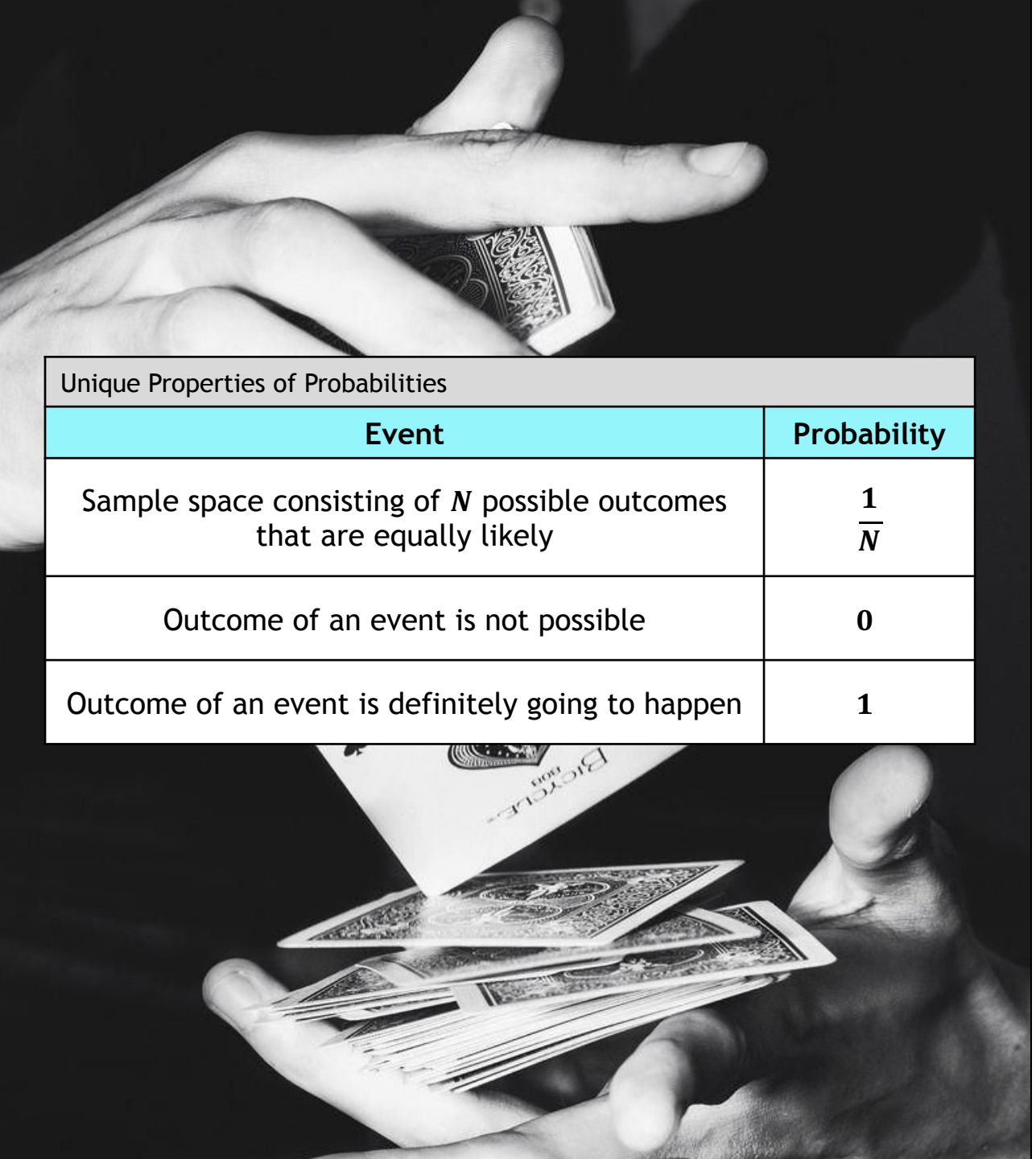
- High overall weightage
- Tested consistently every year
- Typically, an 8m question, 1-2 questions in one of the papers

KEY CONCEPT

Probability

Possibility Diagram & Tree Diagram

Addition & Multiplication Laws



Unique Properties of Probabilities	
Event	**Probability**
Sample space consisting of N possible outcomes that are equally likely	$\frac{1}{N}$
Outcome of an event is not possible	0
Outcome of an event is definitely going to happen	1

Probability

Branch of Mathematics that deals with calculating the likelihood of a given event's occurrence, always expressed as a number between 0 and 1

$$\mathbf{P}(\underbrace{\textbf{rolling a 6 on a fair dice}}_{\text{Event's occurrence}}) = \frac{1}{6}$$

Probability of

Calculate probabilities using the following expression:

$$\mathbf{P}(\textbf{Event}) = \frac{\textbf{Number of favourable outcomes}}{\textbf{Total number of possible outcomes}}$$

Possibility Diagram

Diagram which shows all possible outcomes of an experiment, usually used where each outcome is equally likely to happen

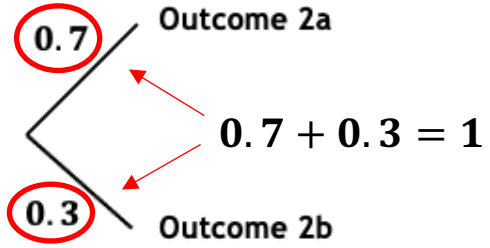
Example: Sum of 2 dices thrown

First Dice

Second Dice +	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Take note:

Probability of every completed branch must add up to 1

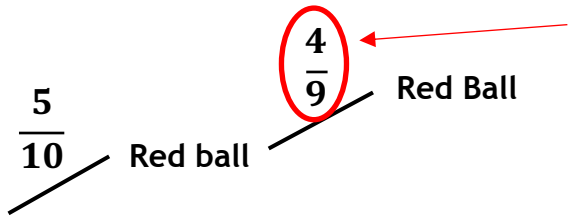


Common Mistake / Examination Phrase:

" … taken out of the bag **without replacement** … "

This means that the object is taken out of the bag, and not placed back inside, this in-turn will change the outcome of the resultant probability

EX: 5 red balls out of 10 balls, 2 balls taken out without replacement



Why $\frac{4}{9}$?

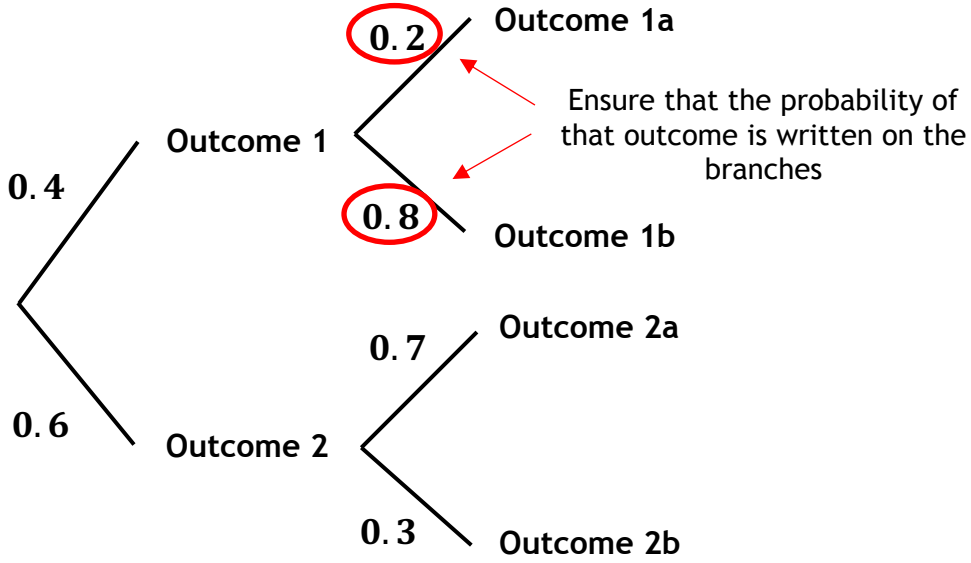
Since there is no replacement, and the first ball taken out is red, there are 9 balls remaining, 4 of which are red

Tree Diagram

Each of the n_1 ways to completing the first outcome is represented as the branch of the tree diagram

Each of the ways to completing the second outcome is represented as n_2 branches from the ends of the original branches and so on…

Example:



Addition & Multiplication Laws

1. Addition Law

Applies for **2** or more mutually exclusive events. When **2** events are mutually exclusive, it means that they cannot happen at the same time

$$\mathbf{P(A\ or\ B)} = \mathbf{P(A} \cup \boldsymbol{B}) = \boldsymbol{P(A)} + \boldsymbol{P(B)}$$

2. Multiplication Law

Applies for **2** or more independent events. When **2** events are independent, it means that the occurrence of one of them has no influence on the occurrence of the other

$$\mathbf{P(A\ and\ B)} = \mathbf{P(A} \cap \boldsymbol{B}) = \boldsymbol{P(A)} \times \boldsymbol{P(B)}$$

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