Organized Counting

Feb 4/2020

There are various methods we use to organize and illustrate our information, particularly results, or outcomes, of our experiments.

(1) Lists (or sets)
(2) Tree diagrams
(3) Charts/tables

e.g., $D = \{x \in \mathbb{R} \mid x > 0\}$

Ex. Determine a set of all possible outcomes for:

(a) flipping a coin

$\{H, T\}$

(b) rolling a 6-sided die

$\{1, 2, 3, 4, 5, 6\}$

(c) flipping a coin twice

$\{HH, TH, HT, TT\}$

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Illustrating Outcomes - Set / List

Ex. Rolling two 6-sided dice

S = { (1,1), (1,2), (1,3), (1,4), (1,5), (1,6),
(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),
(3,1), (3,2), (3,3), (3,4), (3,5), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6) }

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Illustrating Outcomes - Set / List

Ex. Sum of two 6-sided dice

S = { 2, 3, 3, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 9, 9, 9, 9,
10, 10, 10, 11, 11, 12 }

Note: You generally want to track each individual outcome, even if they are the same.

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Illustrating Outcomes - Table / Matrix

Ex. Rolling two 6-sided dice

Outcome		Die 1					
		⚀	⚁	⚂	⚃	⚄	⚅
Die 2	⚀	2	3	4	5	6	7
	⚁	3	4	5	6	7	8
	⚂	4	5	6	7	8	9
	⚃	5	6	7	8	9	10
	⚄	6	7	8	9	10	11
	⚅	7	8	9	10	11	12

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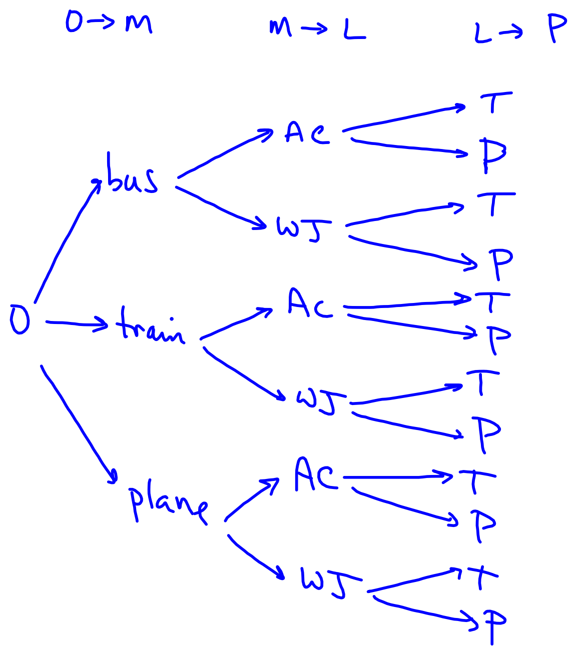
Ex. Consider a trip from Ottawa-Montreal-London-Paris, with the following travel options:
(a) Ottawa-Montreal by bus, train, or plane.
(b) Montreal-London by two airlines (AC or WJ).
(c) London-Paris by plane or train.

Use a tree diagram to solve total number of possible choices.



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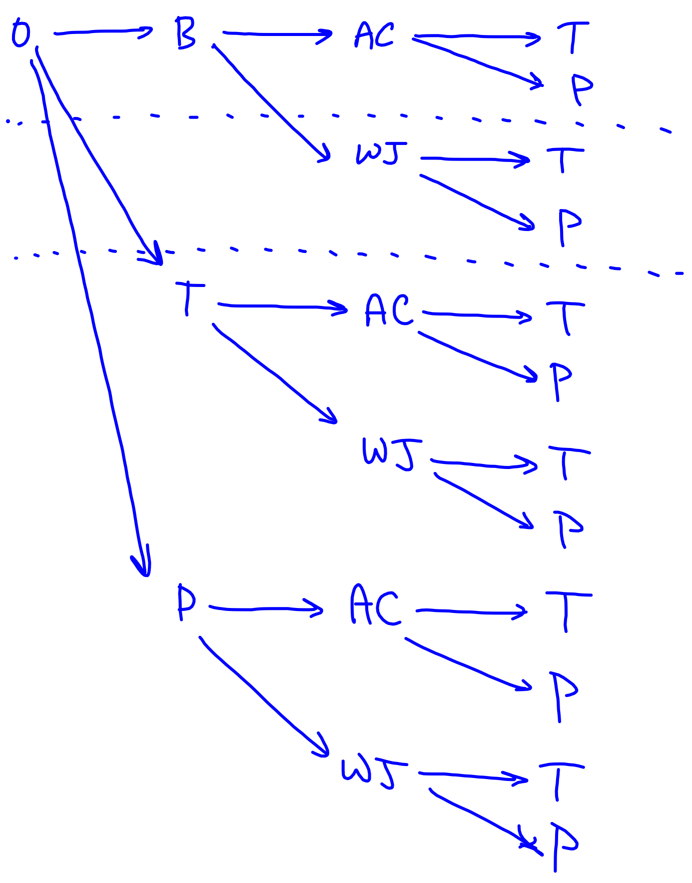

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The Fundamental Counting Principle

If one event can occur in m ways and a second in n ways, then together the number of ways they can occur is:

$$m \times n$$

This can be extended to any number of independent events with distinct choices:

$$m \times n \times p \times \ldots$$

where m is the number of ways to count event 1,
n is the number of ways to count event 2, etc.

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Ex. Consider a trip from Ottawa-Montreal-London-Paris, with the following travel options:
(a) Ottawa-Montreal by bus, train, or plane.
(b) Montreal-London by two airlines (AC or WJ).
(c) London-Paris by plane or train.

Use the fundamental counting principle to solve for the total number of travel options.

$O \to M \quad M \to L \quad L \to P$

$3 \times 2 \times 2 = 12$

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Ex. When buying a new phone, choices are:
- 2GB, 4GB, or 8GB of memory
- 64GB or 128GB of storage
- 10 colours

How many configurations are possible?

$$\underset{3}{\underline{\text{mem}}} \times \underset{2}{\underline{\text{storage}}} \times \underset{10}{\underline{\text{colour}}} = 60$$

$\therefore$ 60 configurations possible.

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Assigned Work:

p. 229 #1-4, 6, 8, 11, 13

2

2.

1st	2nd
3	1
2	2
1	3
5	6
6	5

5 ways to roll 4 or 11

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8. 6-sided, 5 rolls

1st	2nd
1	1
2	2
3	3
4	4
5	5
6	6

6 outcomes × 6 outcomes × 6 × 6 × 6

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11. 6 to 3 final
A B

at half

A	B
6	3
5	2
4	1
3	0
2	
1	
0	

7 outcomes × 4 = 28 possible scores at half.

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