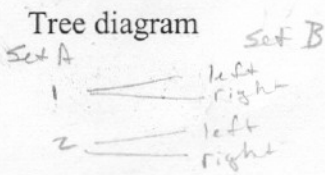# Cartesian Products (p. 44)

**Ordered Pair:** a grouping (not a set) in which the order matters. Ordered pairs are placed in parentheses. (a, b) is an ordered pair in which a comes first and b comes second. A pair of shoes is ordered because it **does matter** which shoe is which (left, right). A pair of socks is not an ordered pair because it **doesn't** matter which sock is which.

**Cartesian Product of two sets:** is a set operation denoted by A × B (read A cross B) <u>is the set of all possible ordered pairs</u> such that the first element of the ordered pair is an element of A and the second element of the ordered pair is an element of B.

× **Charts** or **Tree diagrams** can be used to determine Cartesian Products.

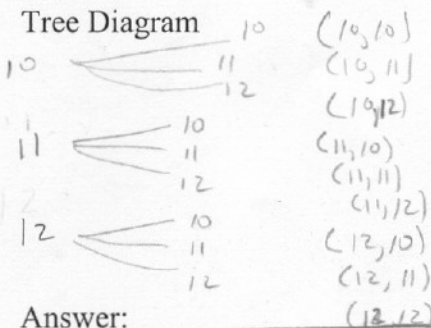**Example 1**: Given A = {1, 2} and B={left, right}, find A × B.

Tree diagram

Set A — Set B

1 — left → (1, left)
    right → (1, right)
2 — left → (2, left)
    right → (2, right)

× Chart

|   | left | right |
|---|------|-------|
| 1 | (1, left) | (1, right) |
| 2 | (2, left) | (2, right) |

Answer: { (1, left), (1, right), (2, left), (2, right) }

**Example 3**: Find A × A if A = {10, 11, 12}.

Tree Diagram

10 — 10 → (10, 10)
     11 → (10, 11)
     12 → (10, 12)
11 — 10 → (11, 10)
     11 → (11, 11)
     12 → (11, 12)
12 — 10 → (12, 10)
     11 → (12, 11)
     12 → (12, 12)

× Chart

|    | 10 | 11 | 12 |
|----|------|------|------|
| 10 | (10, 10) | (10, 11) | (10, 12) |
| 11 | (11, 10) | (11, 11) | (11, 12) |
| 12 | (12, 10) | (12, 11) | (12, 12) |

Answer: { (10,10), (10,11), (10,12), (11,10), (11,11), (11,12), (12,10), (12,11), (12,12) }

**Example 5**: If A = {1, 2, 3}   B={0, 1, 2}   and C = {4, 5}. Find (A ∪ B) × C.

(A ∪ B) = {0, 1, 2, 3}

C = {4, 5}

{ (0, 4), (0, 5), (1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3,

extra

EX  6: A × C = { (1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5) }