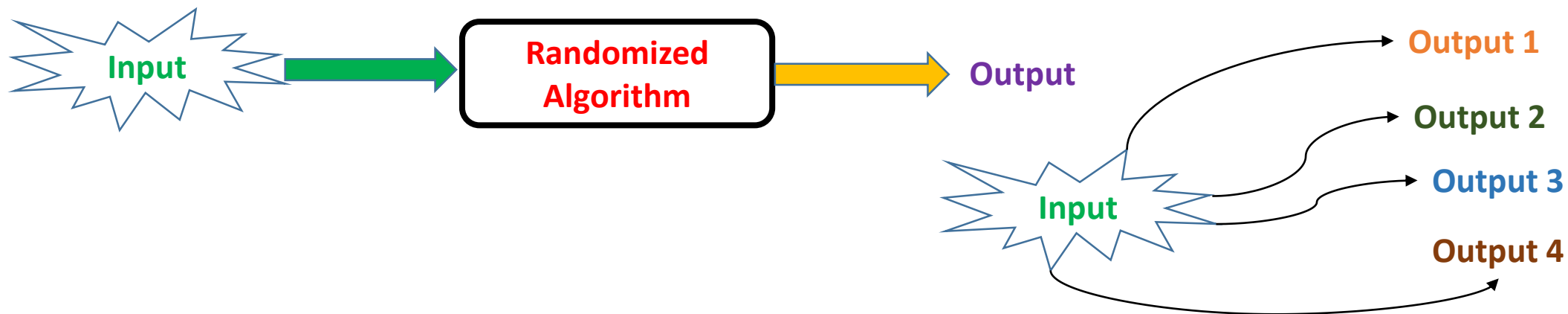# Randomized Algorithms

By

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Randomized Algorithms

- **Deterministic Algorithm**

- **Non-Deterministic Algorithm**

Randomized Algorithms

- Why Randomized algorithms?

- Different sorting algorithms:
  - Bubble Sort
  - Insertion Sort $O(n^2)$
  - Quick Sort

Deterministic Vs Non-Deterministic Algorithms
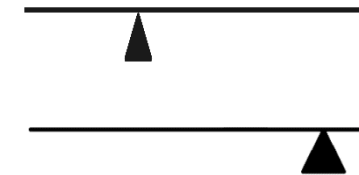
- **Deterministic Algorithm**
  - For a particular input, the computer will give always the same output.
  - Can solve the problem in polynomial time.
  - Can determine the next step of execution.

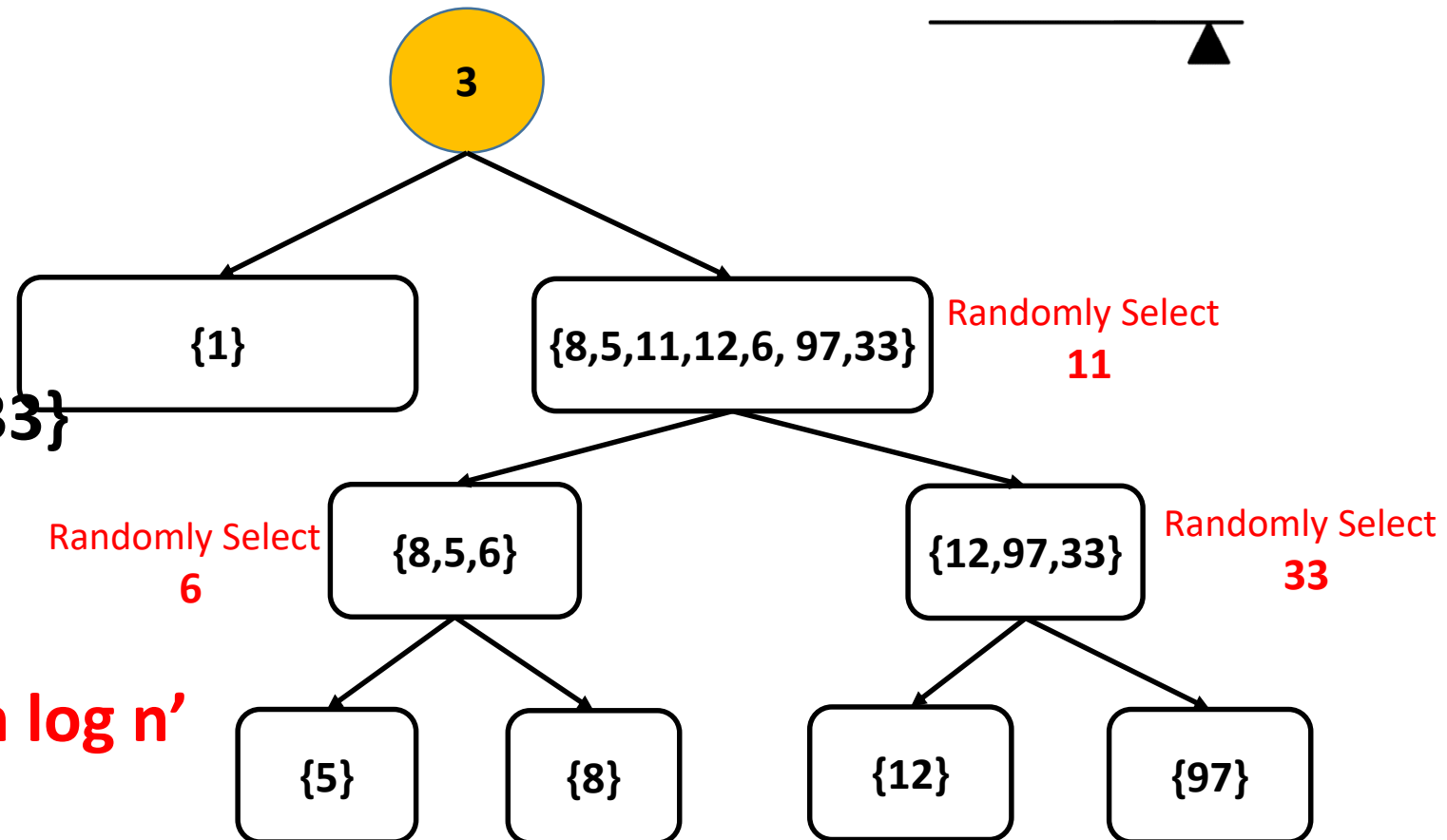- **Non-Deterministic Algorithm**
  - For a particular input the computer will give different outputs on different execution.
  - May or may not solve the problem in polynomial time.
  - Cannot determine the next step of execution due to more than one path the algorithm can take.

Randomized Quick Sort

- $T(n) <= 2T(\frac{n}{2}) + cn$

3

{1}   {8,5,11,12,6, 97,33}   Randomly Select **11**

- **{1, 8, 5, 3, 11, 12, 6, 97, 33}**

Randomly Select **6**   {8,5,6}   {12,97,33}   Randomly Select **33**

Expected Running Time is 'n log n'

{5}   {8}   {12}   {97}

Randomized Algorithms

- **Las Vegas Algorithms**
  - Correct output.
  - Probabilistic Time.

- **Monte Carlo Algorithms**
  - Probabilistic output
  - Correct Time