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CPSC 335-08

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Project 2 Crane Problem

Exhaustive Algorithm Solution Pseudocode & Time Analysis

function crane_unloading_exhaustive(setting: grid) -> path:

  // Check if grid dimensions are valid

  assert(setting.rows() > 0) --> 1

  assert(setting.columns() > 0) ---> 1

  // Calculate the maximum number of steps allowed

  max_steps = setting.rows() + setting.columns() – 2   --> 1

  // Check if the maximum number of steps is within bounds

  assert(max_steps < 64)   --> 1

  // Initialize the best path as the initial setting

  best = path(setting)   --> 1

  // Iterate over different step counts

  for steps = 1 to max_steps: --> n

   // Generate all possible combinations of steps

```
mask = 1 << steps    --> 1
for bits = 0 to mask - 1:    --> n^2


  // Create a candidate path
  candidate = path(setting)    --> 1


  // Initialize validity flag
  valid = true  --> 1


  // Iterate over each bit in the combination
  for i = 0 to steps - 1:   --> n


    // Extract the bit value
    Int bit;    --> 1
    bit = (bits >> i) & 1    ---> 2


    // Check the bit and add corresponding step to the candidate path
    if bit == 1:    --> 1
      if candidate.is_step_valid(STEP_DIRECTION_EAST):   --> 1
        candidate.add_step(STEP_DIRECTION_EAST)   --> 1
    else:
      if candidate.is_step_valid(STEP_DIRECTION_SOUTH):   --> 1
        candidate.add_step(STEP_DIRECTION_SOUTH)   --> 1


  // Check if the candidate path is valid and has more cranes than the current best path
  if valid and (candidate.total_cranes() > best.total_cranes()): --> 1
    best = candidate    --> 1


// Return the best path found
```
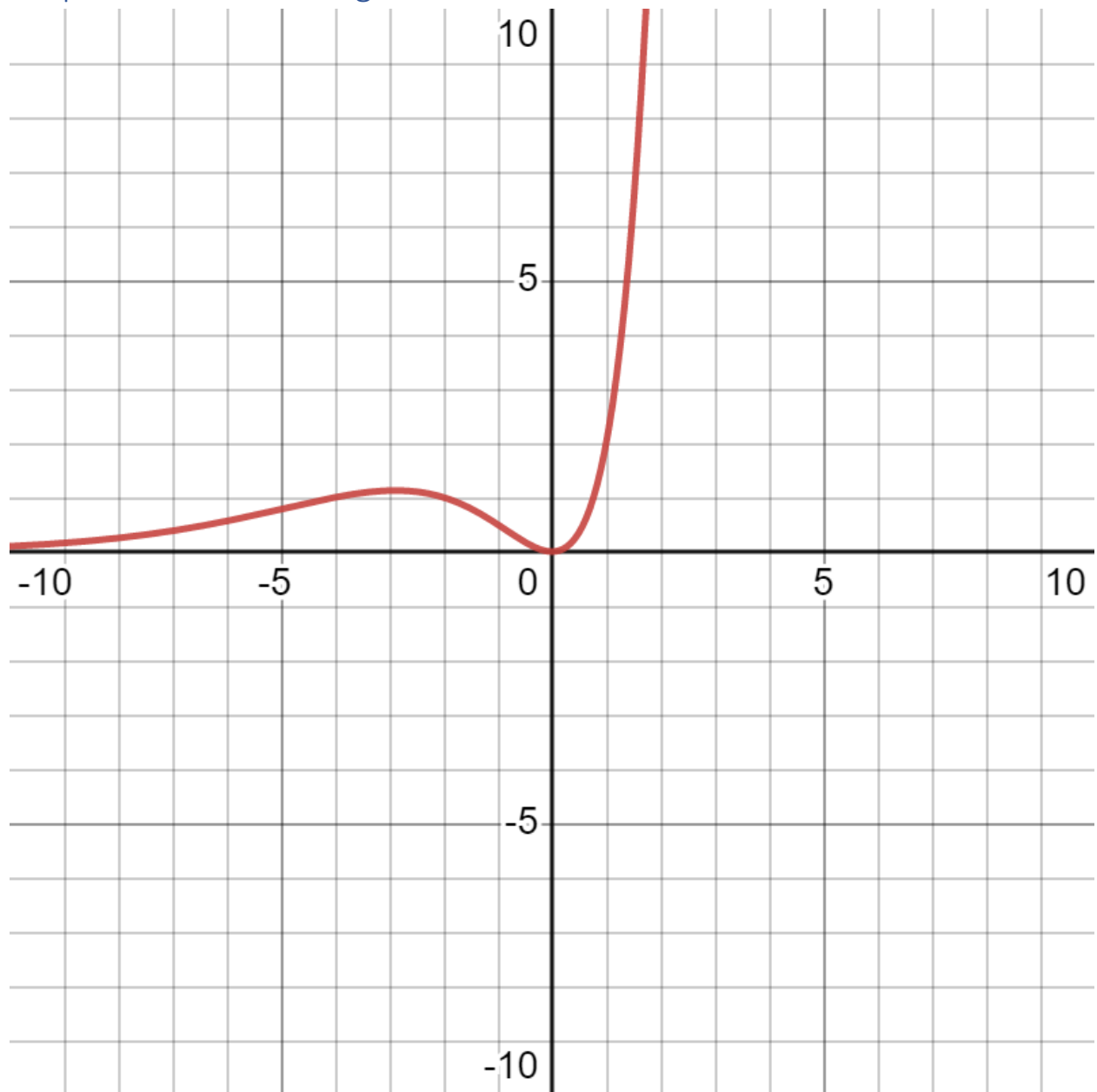
return best --> 1

Calculation: 5 + n *(2^n + (2 +(n +10))) + 1 = O(n^2 * 2^n)
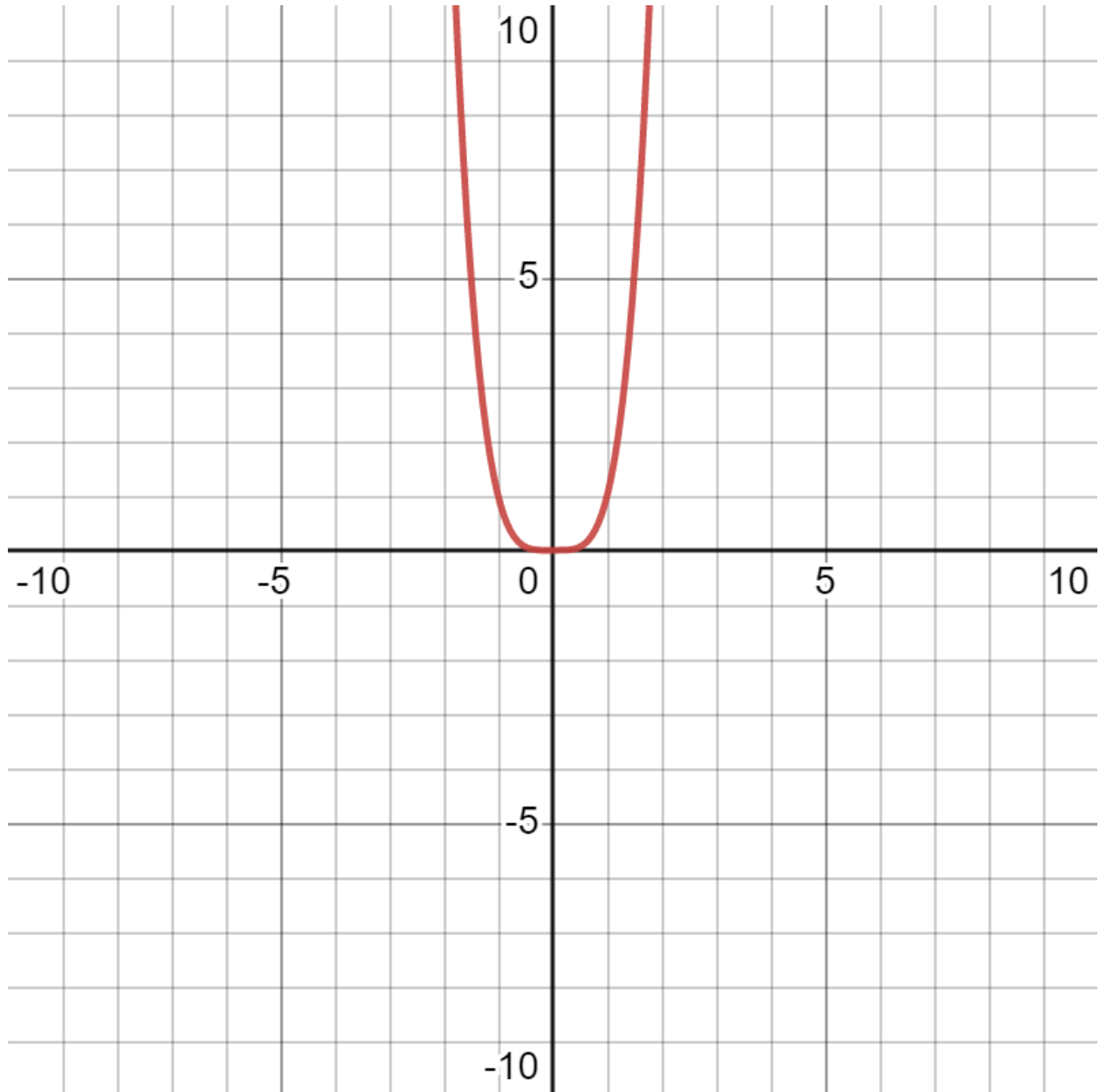

Graph for Exhaustive Algorithm

Dynamic Algorithm Solution Pseudocode & Time Analysis

Calculation: O(n^4)

Graph for Dynamic Algorithm

Questions

3. Is this evidence consistent or inconsistent with hypothesis 1? Justify your answer. The evidence is consistent with hypothesis 1 because after calculating the time complexity for dynamic and exhaustive dynamic ended up being faster than exhaustive because dynamic is O(n^4).