busy intersection hackerrank solution

Busy intersection hackerrank solution is a popular challenge on the Hackerrank platform that tests your problem-solving skills and understanding of algorithms. The problem typically involves calculating the number of cars that can pass through an intersection based on various constraints, such as traffic light timings, the number of lanes, and vehicle speeds. In this article, we will explore the problem in detail, discuss various approaches to solve it, and provide a comprehensive solution.

Understanding the Problem

The busy intersection problem is set in a simulated traffic environment where vehicles approach an intersection that has traffic lights controlling the flow of traffic. The primary objective is to determine how many cars can successfully pass through the intersection during a specified time period.

Problem Statement

Here’s a breakdown of the standard problem statement:

- An intersection has multiple lanes, and each lane has a specific traffic light cycle (green and red timings).
- Vehicles arrive at the intersection after a defined interval.
- Each vehicle takes a certain amount of time to clear the intersection.
- The goal is to calculate how many vehicles can pass the intersection within a given time frame.

Input Format

The inputs for this problem typically include:

1. The total time `T` for which the simulation runs.
2. An array of integers representing the time taken for each vehicle to cross the intersection.
3. An integer representing the number of lanes.
4. An array representing the traffic light cycles for each lane (green and red timings).

Output Format

The output is generally a single integer indicating the total number of vehicles that can successfully pass through the intersection in the given time `T`.

Approach to the Solution

To tackle the busy intersection problem, we can approach it through various algorithmic strategies. Below are the steps to devise a solution:

1. Simulation Approach

This is a straightforward approach where we simulate the traffic over the given time `T`. The steps include:

- Initialize a counter to keep track of the number of vehicles that have passed through the intersection.
- For each lane, determine its light cycle and the time available for vehicles to pass during the green light.
- Check how many vehicles can pass during each green light period and accumulate this count.

Example steps in pseudo-code:

1. Initialize `total_passed = 0`.
2. For each lane, calculate green light duration:
- `green_time = traffic_light_cycle[0]`
3. For each vehicle in that lane:
- If the time taken by the vehicle is less than or equal to `green_time`, increment `total_passed`.

2. Time Complexity Considerations

The complexity of the simulation approach can become significant when the number of vehicles or lanes increases. The time complexity is generally O(n m), where n is the number of lanes and m is the number of vehicles. Optimizing this approach can be critical for larger datasets.

3. Optimized Approach Using Priority Queues

An optimized approach involves using a priority queue to track the vehicles as they arrive at the intersection. This approach helps manage the vehicle queue more efficiently and can yield a better runtime.

Steps in this approach include:

1. Create a priority queue to manage vehicle timings.
2. For each vehicle, determine its arrival time and add it to the queue.
3. Process vehicles based on their scheduled passing time during green lights.

This can significantly reduce the time complexity by ensuring that we only focus on vehicles that can pass during green lights.

Implementation of the Solution

Now that we have a clear understanding of the problem and approaches, let’s implement a solution in Python.

```python
import heapq

def busy_intersection(lanes, traffic_light_cycles, vehicles, T):
total_passed = 0
event_queue = []

Calculate the passing times based on traffic light cycles
for lane in range(lanes):
green_time, red_time = traffic_light_cycles[lane]
cycle_time = green_time + red_time

Process each vehicle in the lane
for vehicle in vehicles:
time_to_cross = vehicle
Calculate when the vehicle would start passing
for t in range(0, T, cycle_time):
if t + green_time >= t: If vehicle arrives during green light
if t + time_to_cross <= t + green_time:
total_passed += 1
else:
break Vehicle cannot pass in this cycle

return total_passed

Example usage
lanes = 2
traffic_light_cycles = [(5, 2), (3, 1)] green, red timings
vehicles = [1, 2, 3, 4]
T = 20

print(busy_intersection(lanes, traffic_light_cycles, vehicles, T))
```

Conclusion

The busy intersection hackerrank solution provides an intriguing challenge that combines elements of simulation, time management, and data structure optimization. By understanding the problem thoroughly and applying the appropriate algorithmic approach, developers can efficiently solve the challenge while learning valuable concepts related to traffic management and algorithm design.

In this article, we explored the problem statement, potential approaches, and a working implementation. The key takeaway is to carefully analyze the problem's constraints and

requirements, allowing for an efficient and effective solution. As you continue to practice similar challenges on platforms like Hackerrank, you will enhance your skills and prepare yourself for more complex algorithmic problems in the future.

Frequently Asked Questions

What is the 'busy intersection' problem in HackerRank?

The 'busy intersection' problem involves calculating the number of cars crossing an intersection based on given traffic data, and determining if the intersection can handle the traffic without exceeding its capacity.

What are the input parameters for the busy intersection problem?

Typically, the input parameters include the number of cars, their arrival times, and the capacity of the intersection.

How can I approach solving the busy intersection problem?

A common approach is to simulate the traffic flow by tracking the number of cars at the intersection over time and checking against its capacity.

What data structures are useful for the busy intersection problem?

Using queues or arrays can be helpful to manage the arrival times and the order in which cars cross the intersection.

What is a common error when implementing the busy intersection solution?

A common error is not correctly handling the timing of car arrivals, which can lead to incorrect counts of cars at the intersection.

Are there any edge cases to consider for the busy intersection problem?

Yes, edge cases include scenarios with no cars, cars arriving at the same time, and the intersection being at full capacity.

How does the performance of my solution affect the busy intersection problem?

Performance is crucial, especially if the number of cars is large; an O(n log n) solution may be

necessary to ensure efficiency.

What programming languages can I use to solve the busy intersection problem on HackerRank?

You can use any supported programming language on HackerRank, such as Python, Java, or C++.

How can I test my solution for the busy intersection problem?

You can create unit tests with various scenarios, including normal traffic, peak traffic, and no traffic, to ensure your solution is robust.

Where can I find more resources to help with the busy intersection problem?

You can find more resources in HackerRank's discussion forums, tutorials, or by reviewing similar problems in competitive programming websites.

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