

Simulation for Milestone 1

We simulate a small number of packets arriving randomly at a single router.

Each packet is assigned a random arrival time and service time.

Packets are served one at a time using first-come-first-serve queue.

For each packet, we compute the delay as the difference between its finish time and arrival time.

This elementary simulation demonstrates queueing and delay behaviour under random traffic.

Code:

```
#include <iostream>
using namespace std;

int main() {
    srand(time(0)); // seed for randomness

    int N = 10; // small number of packets
    double currentTime = 0.0;
    double routerFreeTime = 0.0;
    double totalDelay = 0.0;

    cout << "Packet\tArrival\tService\tStart\tFinish\tDelay\n";

    for (int i = 1; i <= N; i++) {

        // random inter-arrival time (1 to 5 units)
        double interArrival = 1 + rand() % 5;
        currentTime += interArrival;

        // random service time (1 to 4 units)
        double serviceTime = 1 + rand() % 4;

        // packet starts service when router is free
        double startService = max(currentTime, routerFreeTime);
        double finishService = startService + serviceTime;

        // delay = finish - arrival
        double delay = finishService - currentTime;

        totalDelay += delay;
        routerFreeTime = finishService;

        cout << i << "\t"
             << currentTime << "\t"
```

```

        << serviceTime << "\t"
        << startService << "\t"
        << finishService << "\t"
        << delay << endl;
    }

```

```

    cout << "\nAverage Packet Delay = "
        << totalDelay / N << endl;

```

```

    return 0;
}

```

Output:

```

● (base) amk@Abbass-MacBook-Air cse400 % cd "/Users/amk/Desktop/cse400/" && g++ -std=c++1
7 simulation.cpp -o simulation && "/Users/amk/Desktop/cse400/"simulation
Packet  Arrival  Service  Start   Finish  Delay
1       2        2        2       4       2
2       5        2        5       7       2
3       9        4        9      13       4
4      14        3      14      17       3
5      18        1      18      19       1
6      22        4      22      26       4
7      27        1      27      28       1
8      31        4      31      35       4
9      35        4      35      39       4
10     40        1      40      41       1

Average Packet Delay = 2.6
○ (base) amk@Abbass-MacBook-Air cse400 %

```