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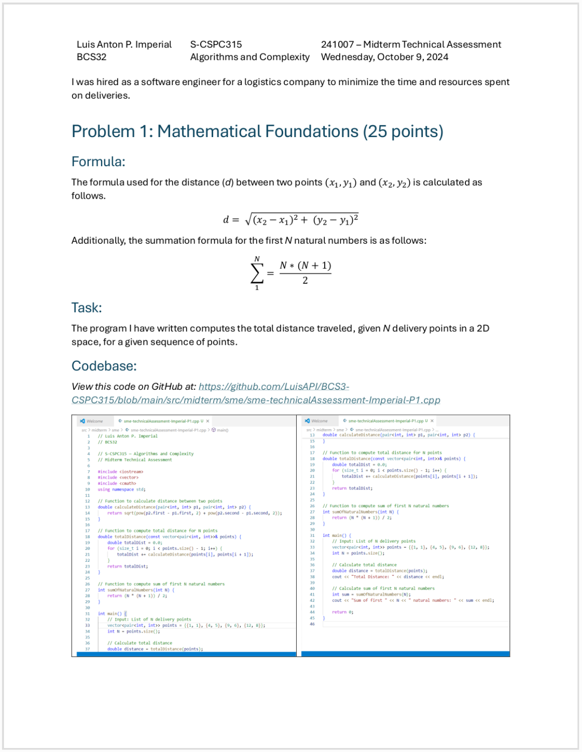

Luis Anton P. Imperial S-CSPC315 241007 – Midterm Technical Assessment
BCS32 Algorithms and Complexity Wednesday, October 9, 2024

I was hired as a software engineer for a logistics company to minimize the time and resources spent on deliveries.

Problem 1: Mathematical Foundations (25 points)

Formula:

The formula used for the distance (d) between two points (x_1, y_1) and (x_2, y_2) is calculated as follows.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Additionally, the summation formula for the first N natural numbers is as follows:

$$\sum_{1}^{N} = \frac{N * (N + 1)}{2}$$

Task:

The program I have written computes the total distance traveled, given N delivery points in a 2D space, for a given sequence of points.

Codebase:

View this code on GitHub at: https://github.com/LuisAPI/BCS3-CSPC315/blob/main/src/midterm/sme/sme-technicalAssessment-Imperial-P1.cpp

Welcome
sme-technicalAssessment-Imperial-P1.cpp U
src > midterm > sme > sme-technicalAssessment-Imperial-P1.cpp > main()

```cpp
// Luis Anton P. Imperial
// BCS32

// S-CSPC315 – Algorithms and Complexity
// Midterm Technical Assessment

#include <iostream>
#include <vector>
#include <cmath>
using namespace std;

// Function to calculate distance between two points
double calculateDistance(pair<int, int> p1, pair<int, int> p2) {
    return sqrt(pow(p2.first - p1.first, 2) + pow(p2.second - p1.second, 2));
}

// Function to compute total distance for N points
double totalDistance(const vector<pair<int, int>>& points) {
    double totalDist = 0.0;
    for (size_t i = 0; i < points.size() - 1; i++) {
        totalDist += calculateDistance(points[i], points[i + 1]);
    }
    return totalDist;
}

// Function to compute sum of first N natural numbers
int sumOfNaturalNumbers(int N) {
    return (N * (N + 1)) / 2;
}

int main() {
    // Input: List of N delivery points
    vector<pair<int, int>> points = {{1, 1}, {4, 5}, {9, 6}, {12, 8}};
    int N = points.size();

    // Calculate total distance
    double distance = totalDistance(points);
```

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src > midterm > sme > sme-technicalAssessment-Imperial-P1.cpp > ...

```cpp
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// Function to compute sum of first N natural numbers
int sumOfNaturalNumbers(int N) {
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}

int main() {
    // Input: List of N delivery points
    vector<pair<int, int>> points = {{1, 1}, {4, 5}, {9, 6}, {12, 8}};
    int N = points.size();

    // Calculate total distance
    double distance = totalDistance(points);
    cout << "Total Distance: " << distance << endl;

    // Calculate sum of first N natural numbers
    int sum = sumOfNaturalNumbers(N);
    cout << "Sum of first " << N << " natural numbers: " << sum << endl;

    return 0;
}
```