STA 3180 Statistical Modelling: Spatial Statistics

Start of Code
1. Write a program to calculate the mean of a set of spatial data points.

```cpp
#include
#include
using namespace std;

int main()
{
        vector dataPoints;
        double sum = 0;
        double mean;

        // Input data points
        cout << "Enter data points: ";
        for (int i = 0; i < dataPoints.size(); i++)
        {
                cin >> dataPoints[i];
                sum += dataPoints[i];
        }
        // Calculate mean
        mean = sum / dataPoints.size();

        // Output mean
        cout << "Mean: " << mean << endl;

        return 0;
}
```
End of Code

Start of Code
2. Write a program to calculate the variance of a set of spatial data points.

```cpp
#include
#include
#include
using namespace std;

int main()
{
        vector dataPoints;
        double sum = 0;
        double mean;
        double variance;

        // Input data points
        cout << "Enter data points: ";
        for (int i = 0; i < dataPoints.size(); i++)
        {
```

```cpp
            cin >> dataPoints[i];
            sum += dataPoints[i];
        }

        // Calculate mean
        mean = sum / dataPoints.size();

        // Calculate variance
        for (int i = 0; i < dataPoints.size(); i++)
        {
            variance += pow(dataPoints[i] - mean, 2);
        }
        variance /= dataPoints.size();

        // Output variance
        cout << "Variance: " << variance << endl;

        return 0;
}
```
End of Code

Start of Code
3. Write a program to calculate the covariance of two sets of spatial data points.
```cpp
#include
#include
#include
using namespace std;

int main()
{
        vector dataPoints1;
        vector dataPoints2;
        double sum1 = 0;
        double sum2 = 0;
        double mean1;
        double mean2;
        double covariance;

        // Input data points
        cout << "Enter data points for set 1: ";
        for (int i = 0; i < dataPoints1.size(); i++)
        {
            cin >> dataPoints1[i];
            sum1 += dataPoints1[i];
        }
        cout << "Enter data points for set 2: ";
        for (int i = 0; i < dataPoints2.size(); i++)
        {
            cin >> dataPoints2[i];
            sum2 += dataPoints2[i];
        }

        // Calculate means
        mean1 = sum1 / dataPoints1.size();
```

```cpp
        mean2 = sum2 / dataPoints2.size();

        // Calculate covariance
        for (int i = 0; i < dataPoints1.size(); i++)
        {
                covariance += (dataPoints1[i] - mean1) * (dataPoints2[i] - mean2);
        }
        covariance /= dataPoints1.size();

        // Output covariance
        cout << "Covariance: " << covariance << endl;

        return 0;
}
```
End of Code

Start of Code
4. Write a program to calculate the correlation coefficient of two sets of spatial data points.

```cpp
#include
#include
#include
using namespace std;

int main()
{
        vector dataPoints1;
        vector dataPoints2;
        double sum1 = 0;
        double sum2 = 0;
        double mean1;
        double mean2;
        double covariance;
        double variance1;
        double variance2;
        double correlationCoefficient;

        // Input data points
        cout << "Enter data points for set 1: ";
        for (int i = 0; i < dataPoints1.size(); i++)
        {
                cin >> dataPoints1[i];
                sum1 += dataPoints1[i];
        }
        cout << "Enter data points for set 2: ";
        for (int i = 0; i < dataPoints2.size(); i++)
        {
                cin >> dataPoints2[i];
                sum2 += dataPoints2[i];
        }

        // Calculate means
        mean1 = sum1 / dataPoints1.size();
```

```cpp
        mean2 = sum2 / dataPoints2.size();

        // Calculate covariance
        for (int i = 0; i < dataPoints1.size(); i++)
        {
                covariance += (dataPoints1[i] - mean1) * (dataPoints2[i] - mean2);
        }
        covariance /= dataPoints1.size();

        // Calculate variances
        for (int i = 0; i < dataPoints1.size(); i++)
        {
                variance1 += pow(dataPoints1[i] - mean1, 2);
                variance2 += pow(dataPoints2[i] - mean2, 2);
        }
        variance1 /= dataPoints1.size();
        variance2 /= dataPoints2.size();

        // Calculate correlation coefficient
        correlationCoefficient = covariance / sqrt(variance1 * variance2);

        // Output correlation coefficient
        cout << "Correlation Coefficient: " << correlationCoefficient << endl;

        return 0;
}
End of Code
```