

assgn6_D1171708 Brian

In this assignment. Firstly. we have to finish the vector.cpp, smatrix. cpp and matrix. cpp. we can find most of the functions from the practice assignment. The only thing we have to do is the svector_replace function. By

```
Matrix result(mat);
for (int i = 0; i < row; ++i) {
    result.setElement(i, colIndex, m[i][0]);
}
return result;
```

Next, we have to complete the linear equation system solver. cpp by covert C to vector. We have to determine the initial size of the N*N matrix and then randomly generate the element of each row. and also generate the vector of c to create the linear equations.

```
int n;
while(n <= 0 || n > 10){
    cout << "Enter the number of variables (n): ";
    cin >> n;
}

SMatrix A(n);
Vector C(n);

for (int i = 0; i < n; ++i) {
    for (int j = 0; j < n; ++j) {
        A.setElement(i, j, static_cast<double>(rand()) / RAND_MAX);
    }
    C.setElement(i, 0, static_cast<double>(rand()) / RAND_MAX);
}
```

Use the determinant() and vector_replace() to find out the solution of the column.

```
Vector X(n);
for (int i = 0; i < n; ++i) {
    Matrix Ai = C.vector_replace(i, A);
    SMatrix Si(Ai);
    double detAi = Si.determinant();
    X.setElement(i, 0, detAi / detA);
}
return X;
```

Last, use these solutions to plug into the polynomial to verify whether the solution is correct or not.

```
Matrix AX_matrix = A*X;
Vector AX(AX_matrix, 0);
Matrix AX_minus_C_matrix = AX - C;
Vector AX_minus_C(AX_minus_C_matrix, 0);

int n = AX_minus_C.getRow();
for (int i = 0; i < n; ++i) {
    if (abs(AX_minus_C.getElement(i, 0)) < 1e-6) {
        cout << "    Equation " << i << " passes." << endl;
    }
}
```