Group 3 Work 1

Task 1

```
MatrixNameA = {{0.023406, 3.134051, 0.001111, -3.093427},
    {-3.122221, 5.333354, 1.112223, 2.223956}, {0.003459, 5.667891,
     -2.555613, 0.111112}, {0.330000, -1.126781, 2.267101, 3.334512}};

MatrixNameW = {{1.0 * 10^-8, 1.0 * 10^-6, 1.0 * 10^-8, 1.0 * 10^-7},
    {1.0 * 10^-7, 1.0 * 10^-7, 1.0 * 10^-6, 1.0 * 10^-9}, {1.0 * 10^-6, 1.0 * 10^-8,
     1.0 * 10^-7, 1.0 * 10^-6}, {1.0 * 10^-8, 1.0 * 10^-6, 1.0 * 10^-6, 1.0 * 10^-7}};

SizeM = 4;

FunctionINK[n_, k_] := (
  Clear[m];
  m = Table[0, n, n];
  For[i = 1, i ≤ n, i++,
   For[j = 1, j ≤ n, j++,
    If[i == j, m[[i, j]] = 1, Continue]]];
  m[[k, k]] = 0;
  m
 )

FunctionTNKL[n_, k_, l_] := (
  Clear[m];
  m = Table[0, n, n];
  For[i = 1, i ≤ n, i++,
   For[j = 1, j ≤ n, j++,
    If[i == k, m[[i, 1]] = 1, Continue]]];
  m
 )

FunctionAA[m_, s_, f_] := (
  a =
   Abs[Det[FunctionINK[m, s].MatrixNameA.FunctionINK[m, f] + FunctionTNKL[m, s, f]]];
  a
 )

ClearAll[u, f];

Sum[Sum[(FunctionAA[SizeM, u, f] * MatrixNameW[[u, f]]), {u, 1, SizeM}], {f, 1, SizeM}]
```

```
0.0000525736
```

```
deltaMatrixNameA = %
```

```
0.0000525736
```

```
Det[MatrixNameA]
```

```
-209.801
```

```
MemberQ[{Det[MatrixNameA] - deltaMatrixNameA, Det[MatrixNameA] + deltaMatrixNameA}, 0]
```

```
False
```

Task 2

```
A_X = {{10.000000, 3.000000}, {0.3333333333, 0.110000}}
```

```
{{10., 3.}, {0.333333, 0.11}}
```

```
A_X // MatrixForm
```

$$\begin{pmatrix} 10. & 3. \\ 0.333333 & 0.11 \end{pmatrix}$$

```
b_X = {0.100000, -3.000121}
```

```
{0.1, -3.00012}
```

```
b_X // MatrixForm
```

$$\begin{pmatrix} 0.1 \\ -3.00012 \end{pmatrix}$$

```
Det[A_X] ≠ 0
```

```
True
```

```
epsilone = 10^-6
```

$$\frac{1}{1\,000\,000}$$

```
delta = Det[A_X + epsilone] - Det[A_X]
```

$$6.77667 \times 10^{-6}$$

```
upperBound = Max[Table[Plus @@ A_X[[All, i]] + epsilone, {i, 1, 2}]]
```

```
10.3333
```

```
lowerBound = Max[Table[Plus @@ A_X[[All, i]] - epsilone, {i, 1, 2}]]
```

```
10.3333
```

```
inversedA = Inverse[A_X + epsilone]
```

```
{{1.09994, -29.998}, {-3.33312, 99.9932}}
```

```
upperBoundInv = 1/Abs[Det[A_X] - delta] Max[Table[Plus @@ A_X[[i]] + epsilone, {i, 1, 2}]]
```

```
130.009
```

```
lowerBoundInv = 1/Abs[Det[A_X] + delta] Max[Table[Plus @@ A_X[[i]] - epsilone, {i, 1, 2}]]
```

```
129.991
```

```
condA = upperBoundInv * upperBound >= 1
```

```
True
```

```
deltaA = epsilone * 2
```

$$\frac{1}{500\,000}$$

```
δA = deltaA / upperBound
```

$$1.93548 \times 10^{-7}$$

```
normB = Plus @@ (Abs /@ b_X + epsilone)
```

$$3.10012$$

```
δX = upperBoundInv * upperBound * (δA + δA)
```

$$0.000520035$$

```
LinearSolve[A_X, b_X]
```

$$\{90.1136, -300.345\}$$