Case 0

```
case 0       % example in reference [1] and [2]; not for grading
    % contact point position
    p1 = [2; 0; 0];
    p2 = [0; 1.5; 0];
    p3 = [0; 0; 2];
    p4 = [1.2; -2; 0];


    CP = [p1 p2 p3 p4];


    % inward-pointing contact normal direction
    n1 = [-1; 0; 0];
    n2 = [0; -1; 0];
    n3 = [0; 0; -1];
    n4 = [0; 1; 0];


    CN = [n1 n2 n3 n4];


    % friction coefficient (try both of values)
    %mu = 0.3;
    mu = 0.3;

    % the number of side facets of a linearized polyhedral friction cone
    M = 100;
```

If we try testing case 0 with $\mu = 0.3$, we take the following results:

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```
bFC =

   logical

    0
```

```
zmax =

   NaN
```

```
bFCF =

   logical

    0
```

```
zmaxF =

   1.1705
```
$z_{max} > 1$, hence this is not a force closure grasp.

Running case 0 again but with $\mu = 0.5$ this time, we get:

```
bFC =

   logical

    0
```

```
zmax =

   NaN
```

```
bFCF =

   logical

    1
```

```
zmaxF =

   0.7493
```
which is a force closure grasp, and therefore our code works, based on the example listed on the given paper.

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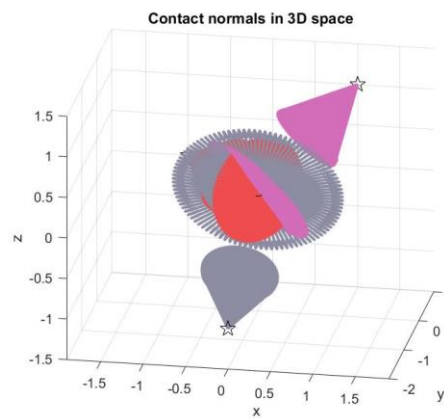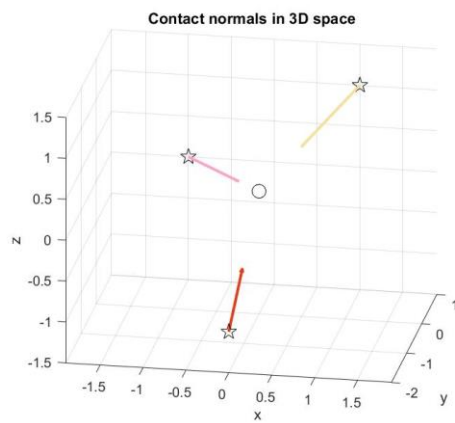
Case 1:

- $\text{TEST} = 1$

$$CP = \begin{bmatrix} p1 & p2 & p3 \end{bmatrix} = \begin{bmatrix} 1 & -1 & 0 \\ 1 & 1 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$

$$CN = \begin{bmatrix} n1 & n2 & n3 \end{bmatrix} = \begin{bmatrix} -1 & 1 & 0 \\ -1 & -1 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

$$mu = 0.5$$
$$M = 100$$

Contact normals in 3D space

Contact normals in 3D space

```
>> part1(1)

Optimal solution found.


bFC =

   logical

    0


zmax =

   NaN
```

```
bFCF =

   logical

    1


zmaxF =

    0.1560
```

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Case 2:

- TEST = 2

$$CP = \begin{bmatrix} p1 & p2 & p3 & p4 & p5 \end{bmatrix} = \begin{bmatrix} -0.81 & -1.75 & 1.49 & 0.49 & 1.23 \\ 1.26 & -1.37 & 0.85 & -2.57 & -1.04 \\ 1.23 & 0.74 & -1.39 & -0.39 & 1.20 \end{bmatrix}$$

$$CN = \begin{bmatrix} n1 & n2 & n3 & n4 & n5 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ -1 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & -1 \end{bmatrix}$$

$$mu = 0.2$$
$$M = 100$$

```
zmax =

    NaN
```

```
>> part1(2)

Optimal solution found.

bFC =

    logical

    0
```

```
bFCF =

    logical

    1
```

```
zmaxF =

    0.7294
```

Contact normals in 3D space

Contact normals in 3D space

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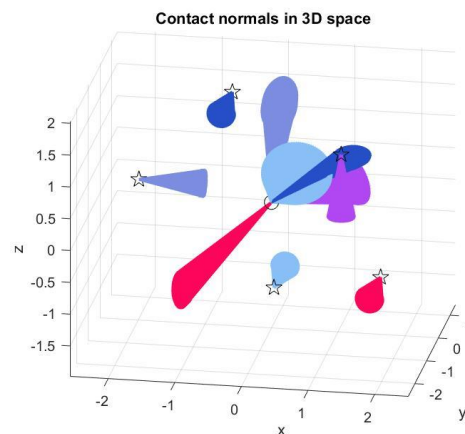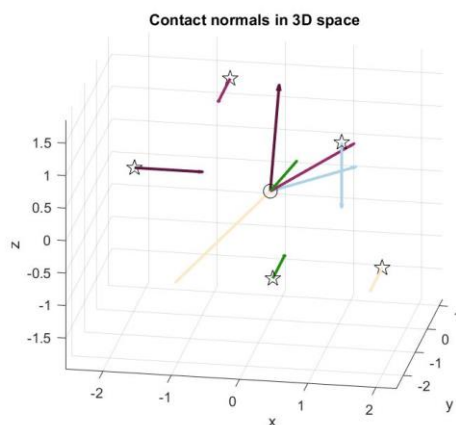
part2(false) – Frictionless Contact

```
N =

     7


CP =

      0.6587     0.2197    -0.1545    -0.8148     0.7755    -0.1029    -0.6247
      0.5828    -0.7222    -0.7193    -0.4848    -0.4069     0.8869    -0.4996
     -0.3766    -0.6762     0.7348     0.1675     0.4357    -0.2960     0.4937
```
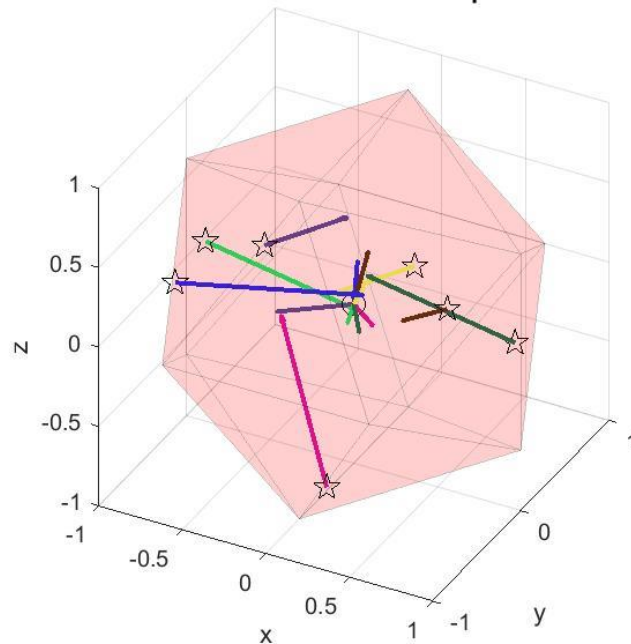
```
W =

    -0.5774    -0.5774          0     0.9342    -0.5774          0     0.5774
    -0.5774     0.5774     0.9342     0.3568     0.5774    -0.9342     0.5774
     0.5774     0.5774    -0.3568          0    -0.5774     0.3568    -0.5774
     0.1190    -0.0266    -0.4298    -0.0598    -0.0167     0.0400     0.0035
    -0.1629     0.2636    -0.0551     0.1565     0.1962     0.0367    -0.0757
    -0.0438    -0.2901    -0.1443     0.1621     0.2128     0.0961    -0.0722
```

```
zmax =

      0.5616
```


Contact normals in 3D space

The results make sense, since theorem 5.6 says that a frictionless force closure grasp requires at least 7 fingers.

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part2(true) – Frictional Contact

```
Optimal solution found.


N =

     3


CP =

    0.7216   -0.8607    0.3985
   -0.4814    0.3647    0.2366
   -0.4150    0.1592    0.8478


zmaxF =

    0.9471
```


Contact normals in 3D space

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