

```

#!/usr/bin/env python2
# -*- coding: utf-8 -*-
"""
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"""

import numpy as np

#Question 6

#for contact 1
a = np.array([[ -1,  0,  0]])
b = np.array([[ 0,  0, -1],[ 0,1,0],[ 1,0,0]])

#for contact 2
a = np.array([[ 1,  0,  0]])
b = np.array([[ 0,  0,  1],[ 0,1,0],[ -1,0,0]])

c = np.cross(a,b)
zero = np.zeros((3,3))
temp = np.vstack((zero,b))
Ad = np.hstack((np.vstack((b,c)),temp))

B = np.array([[ 0],[ 0],[ 0],[ 0],[ 0],[ 1]])

out = np.dot(Ad.T,B)

G = np.array([[ 0.,  0],
               [ 0.,  0],
               [ 0.,  0],
               [ 1., -1],
               [ 0.,  0],
               [ 0.,  0]])

f = np.array([[ -2],[ -5]])

F = G.dot(f)

#Question 7

a = np.array([[ -1,  0,  0]])
b = np.array([[ 0,  0, -1],[ 0,1,0],[ 1,0,0]])

#for contact 2
a = np.array([[ 1,  0,  0]])
b = np.array([[ 0,  0,  1],[ 0,1,0],[ -1,0,0]])

c = np.cross(a,b)
zero = np.zeros((3,3))
temp = np.vstack((zero,b))
Ad = np.hstack((np.vstack((b,c)),temp))

B = np.zeros((6,3))
B[3:,:]= np.identity(3)

out = np.dot(Ad.T,B)

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#combine for parts 3 and 4
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G1 = np.array([[ 0.,  0.,  0.],  
               [-1.,  0.,  0.],  
               [ 0., -1.,  0.],  
               [ 0.,  0.,  1.],  
               [ 0.,  1.,  0.],  
               [-1.,  0.,  0.]])
```

```
G2 = np.array([[ 0.,  0.,  0.],  
               [-1.,  0.,  0.],  
               [ 0.,  1.,  0.],  
               [ 0.,  0., -1.],  
               [ 0.,  1.,  0.],  
               [ 1.,  0.,  0.]])
```

```
G = np.hstack((G1,G2))
```

```
#calculate contact forces with constraints
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```
m = 1  
g = 9.8  
mu = 0.2  
f1 = 0.5*m*g  
f3 = np.sqrt(f1**2)/mu
```

```
fc1 = np.array([-f1],[0],[f3])  
fc2 = np.array([f1],[0],[f3])
```

```
fc = np.vstack((fc1,fc2))
```

```
F = np.dot(G,fc)  
print(F)
```