

## Homework 6.

N1

$$1) M = d F \cdot \sin \theta = 3F \cdot \sin 90^\circ = 3F$$

$$2) M = d F \cdot \sin \theta \quad \text{The force and the distance are same for all 4 of them.}$$

$$\sin \theta \text{ is max when } \theta = 90^\circ \rightarrow Q \text{ is max}$$

$$\sin \theta \text{ is min when } \theta = 0^\circ \text{ or } 180^\circ \Rightarrow S \text{ is min}$$

$$3) M \cdot r = (r \times F) \cdot r = F \cdot (r \times r) = F \cdot (|r| \cdot |r| \sin 0^\circ) = 0$$

$$4) M = M_1 + M_2 = 5N \cdot 2m + (-10N) \cdot 3m = 10 - 30 = -20 N \cdot m$$

$$5) F = 10 \hat{k} \quad r = 5 \hat{j}$$

$$M = r \times F = 5 \hat{j} \times 10 \hat{k} = 50 \hat{i}$$

$$6) r = \hat{i} + 2\hat{j} \quad F = 10\hat{i} + 20\hat{j} + 30\hat{k}$$

$$M = r \times F = (\hat{i} + 2\hat{j}) \times (10\hat{i} + 20\hat{j} + 30\hat{k}) = 20\hat{k} - 30\hat{j} - 20\hat{k} + 60\hat{i} = 60\hat{i} - 30\hat{j}$$

Moment of the force about y-axis is  $-30 N$

## w2 - URDF

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<robot name="Robot1">  
  <link name="link1">  
  <link name="link2">  
  <link name="link3">  
  <link name="link4">
```

```
<joint name="join1">  
  <parent link="link1/>  
  <child link="link3/>  
</joint>
```

```
<joint name="join2">  
  <parent link="link1/>  
  <child link="link2/>  
</joint>
```

```
<joint name="join3">  
  <parent link="link3/>  
  <child link="link4/>  
</joint>  
</robot>
```

```
<robot name="Robot1">  
  <link name="link1">  
  <link name="link2">  
  <link name="link3">  
  <link name="link4">
```

```
<joint name="join1">  
  <parent link="link1/>  
  <child link="link3/>  
</joint>
```

```
<joint name="join2">  
  <parent link="link1/>  
  <child link="link2/>  
</joint>
```

```
<joint name="join3">  
  <parent link="link3/>  
  <child link="link4/>  
</joint>  
</robot>
```

```
<robot name="Robot1">  
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  <link name="link2">  
  <link name="link3">  
  <link name="link4">
```

```
<joint name="join1">  
  <parent link="link1/>  
  <child link="link3/>  
</joint>
```

```
<joint name="join2">  
  <parent link="link1/>  
  <child link="link2/>  
</joint>
```

```
<joint name="join3">  
  <parent link="link2/>  
  <child link="link4/>  
</joint>  
</robot>
```

There are actually a lot of solutions.