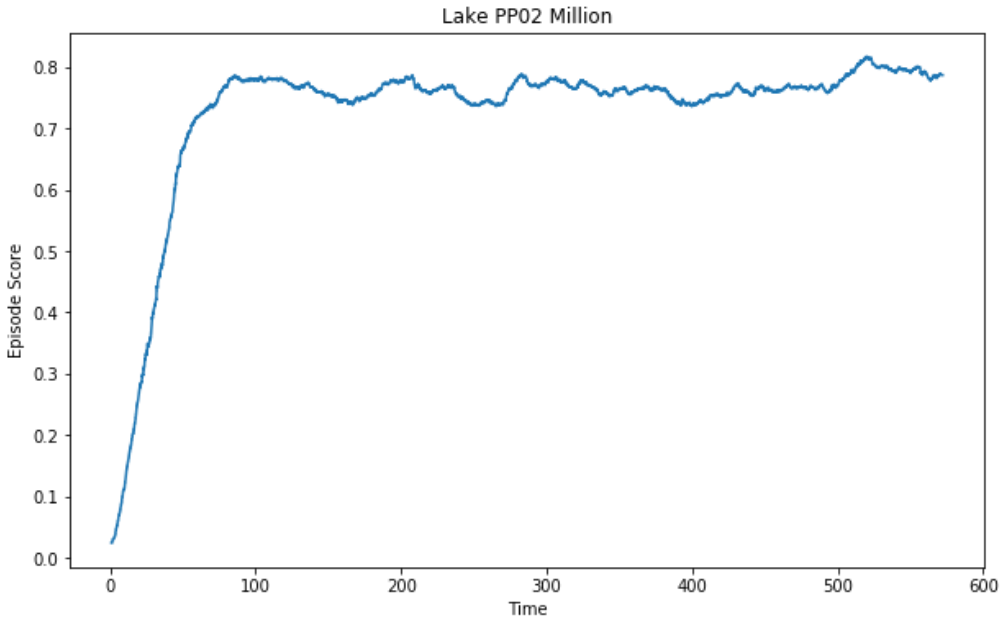
In [86]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
```

In [87]:
```
k = 1000
```

In [88]:
```
# LAKE PP02 Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_pp02_million.csv")
lake_pp02_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_ppo2_time = pd.to_numeric(lake_pp02_million_df.t.values)
pp02_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake PP02 Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_ppo2_time , pp02_my);

ppo2_hy2 = []
for i in range(len(pp02_my) - k):
    num = 0
    for j in range(k):
        num += pp02_my[i+j]
    ppo2_hy2.append(num/k)

ax.plot(x_ppo2_time[:-k], ppo2_hy2);
max(ppo2_hy2)
```

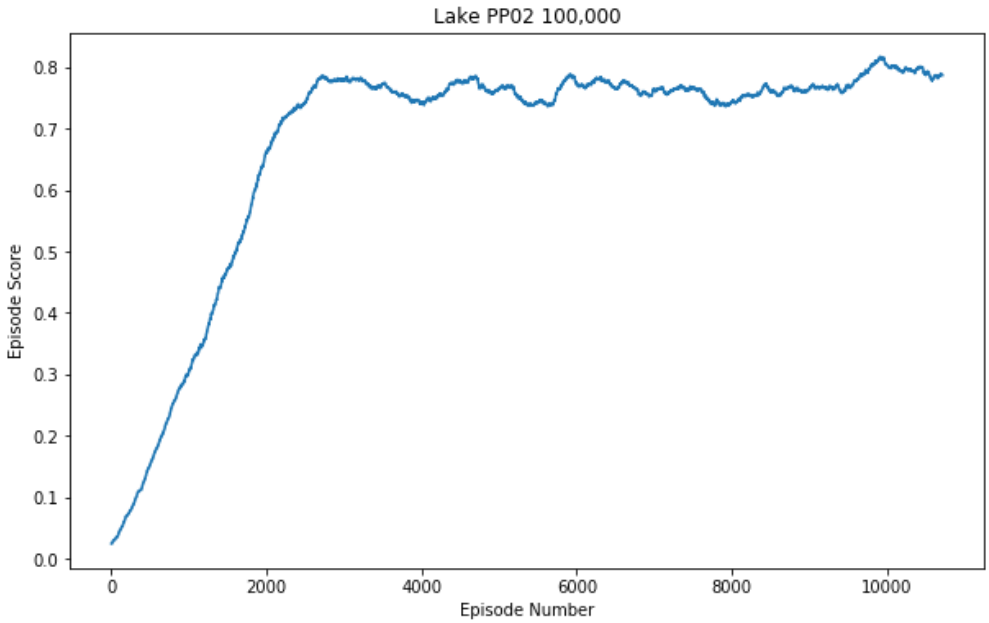
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[88]: 0.817



In [89]:
```
# LAKE PP02 100,000
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_pp02_million.csv", index_col=False)
lake_pp02_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_h = pd.to_numeric(lake_pp02_million_df.index.values)
pp02_hy = pd.to_numeric(lake_pp02_million_df.r.values)
ax.set_title("Lake PP02 100,000")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x_h , pp02_hy);

ppo2_hy2 = []
for i in range(len(pp02_hy) - k):
    num = 0
    for j in range(k):
        num += pp02_hy[i+j]
    ppo2_hy2.append(num/k)

ax.plot(x_h[:-k], ppo2_hy2);
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:5: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  """
```



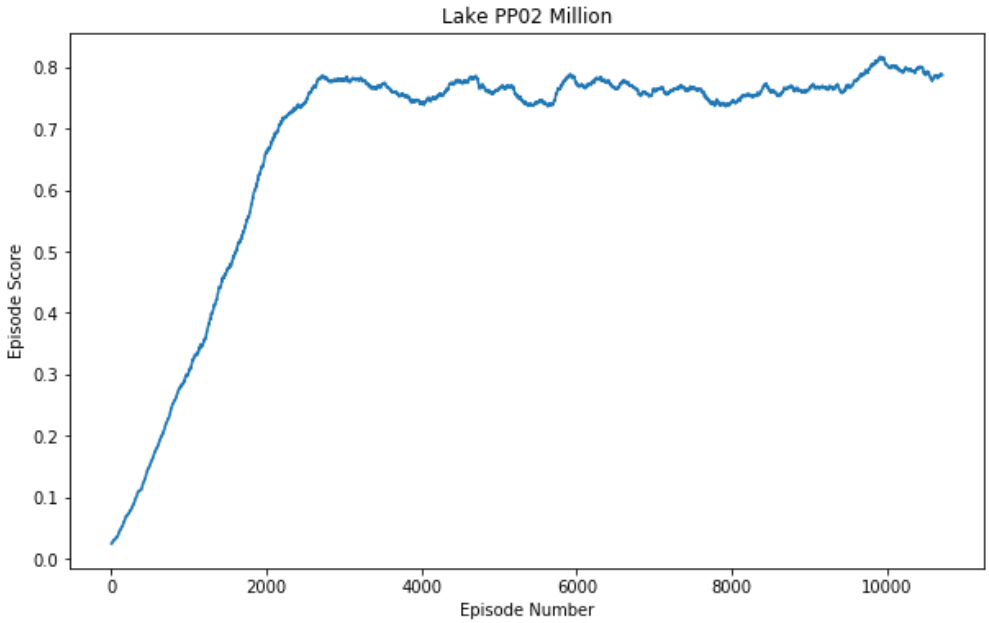
In [90]:
```
file_data
lake_pp02_million_df
```

Out[90]:

	r	l
0	0.0	18
1	0.0	36
2	0.0	30
3	0.0	37
4	0.0	19
5	0.0	27
6	0.0	56
7	0.0	12
8	0.0	77
9	0.0	13
10	0.0	16
11	0.0	13
12	0.0	16
13	0.0	31
14	0.0	46
15	0.0	33
16	0.0	13
17	0.0	8
18	0.0	18
19	0.0	10
20	0.0	39
21	0.0	23
22	0.0	45
23	0.0	7
24	0.0	52
25	0.0	6
26	0.0	10
27	0.0	15
28	0.0	35
29	0.0	24
...	...	...
11691	1.0	38
11692	1.0	57
11693	1.0	62
11694	1.0	81
11695	1.0	72
11696	1.0	158
11697	1.0	175
11698	0.0	200

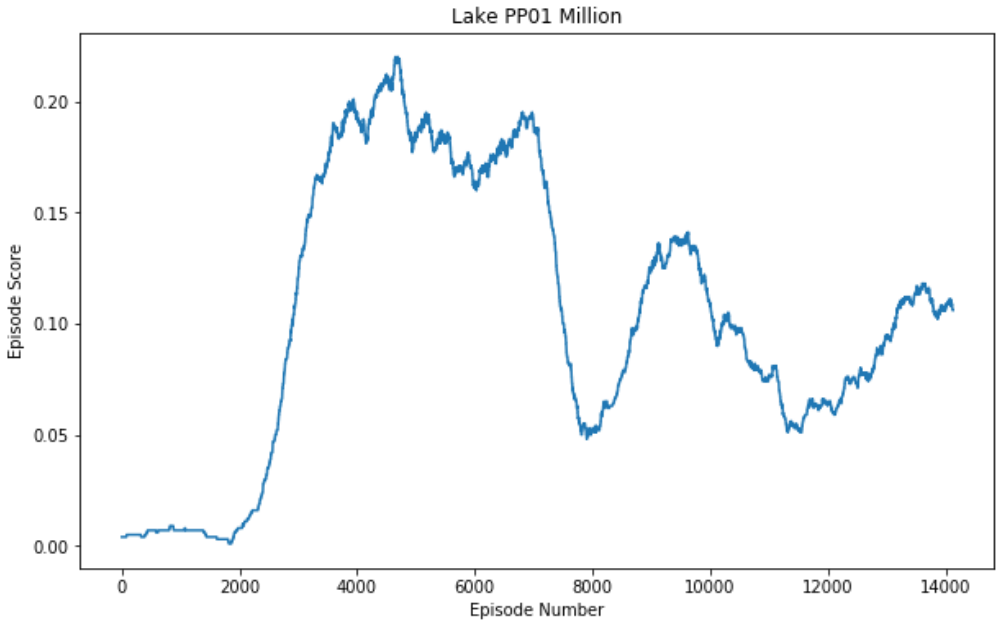
In [91]:
```
# LAKE PP02 MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_pp02_million.csv", index_col =False)
lake_pp02_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_m = pd.to_numeric(lake_pp02_million_df.index.values)
pp02_my = pd.to_numeric(lake_pp02_million_df.r.values)
ax.set_title("Lake PP02 Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x_m , pp02_my);

ppo2_my2 = []
for i in range(len(pp02_my) - k):
    num = 0
    for j in range(k):
        num += pp02_my[i+j]
    ppo2_my2.append(num/k)

ax.plot(x_m[:-k], ppo2_my2);
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [92]:
```
# LAKE PP01 MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_ppo1_million.csv", index_col=False)
lake_pp01_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_pp01_million_df.index.values)
pp01_my = pd.to_numeric(lake_pp01_million_df.r.values)
ax.set_title("Lake PP01 Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x , pp01_my);

ppo1_my2 = []
for i in range(len(pp01_my) - k):
    num = 0
    for j in range(k):
        num += pp01_my[i+j]
    ppo1_my2.append(num/k)

ax.plot(x[:-k], ppo1_my2);
```

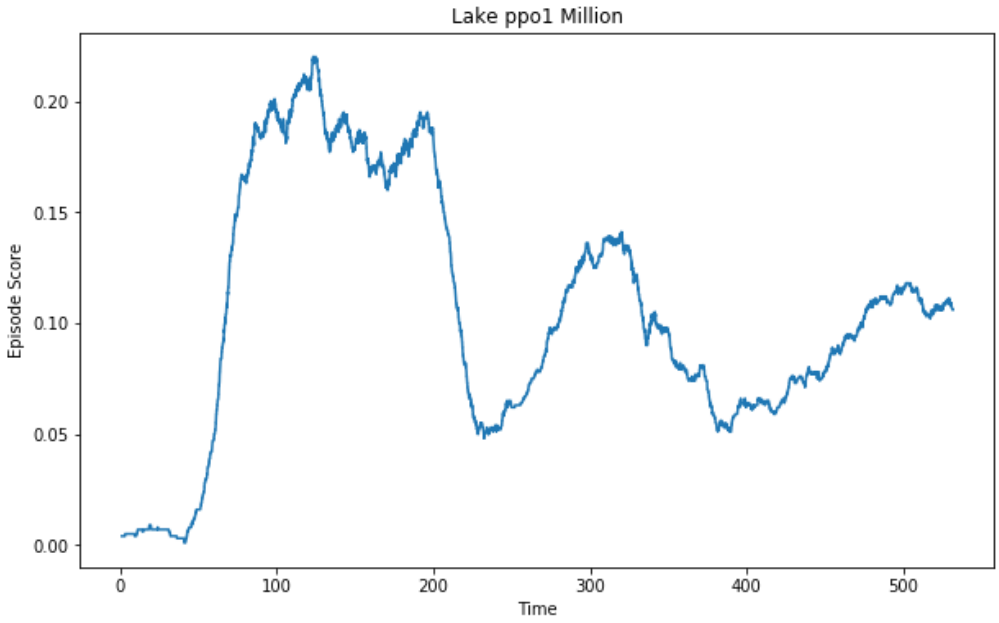
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [93]:
```
# LAKE ppo1 Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_ppo1_million.csv")
lake_ppo1_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_ppo1_time = pd.to_numeric(lake_ppo1_million_df.t.values)
ppo1_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake ppo1 Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_ppo1_time , ppo1_my);

ppo1_hy2 = []
for i in range(len(ppo1_my) - k):
    num = 0
    for j in range(k):
        num += ppo1_my[i+j]
    ppo1_hy2.append(num/k)

ax.plot(x_ppo1_time[:-k], ppo1_hy2);
max(ppo1_hy2)
```

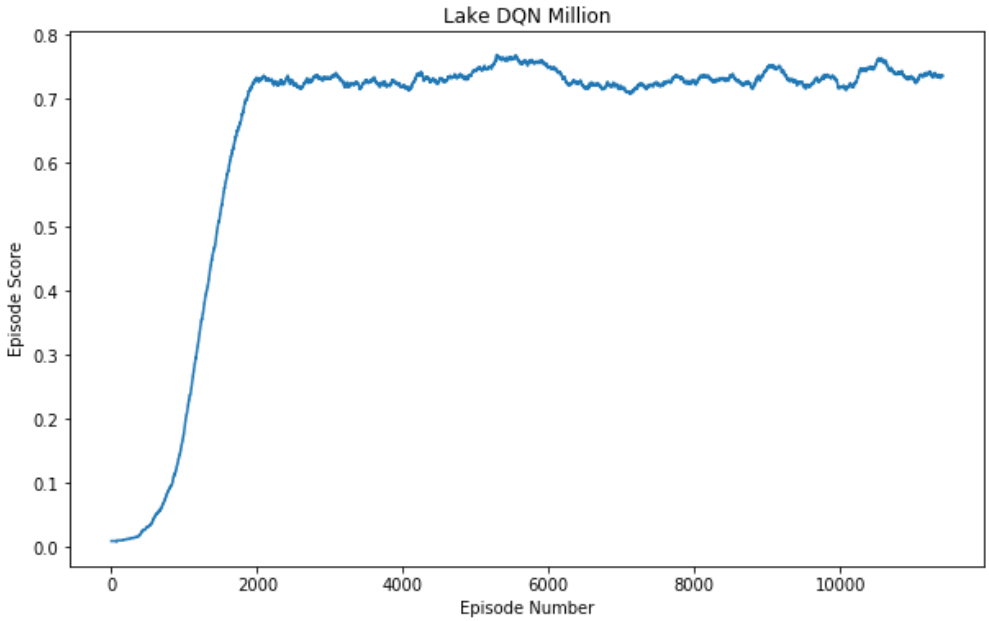
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[93]: 0.22



In [94]:
```
# LAKE DQN Million
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_dqn_million.csv", index_col=False)
lake_dqn_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_data
.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_dqn_million_df.index.values)
dqn_my = pd.to_numeric(lake_dqn_million_df.r.values)
ax.set_title("Lake DQN Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x , dqn_my);

dqn_my2 = []
for i in range(len(dqn_my) - k):
    num = 0
    for j in range(k):
        num += dqn_my[i+j]
    dqn_my2.append(num/k)

ax.plot(x[:-k], dqn_my2);
```

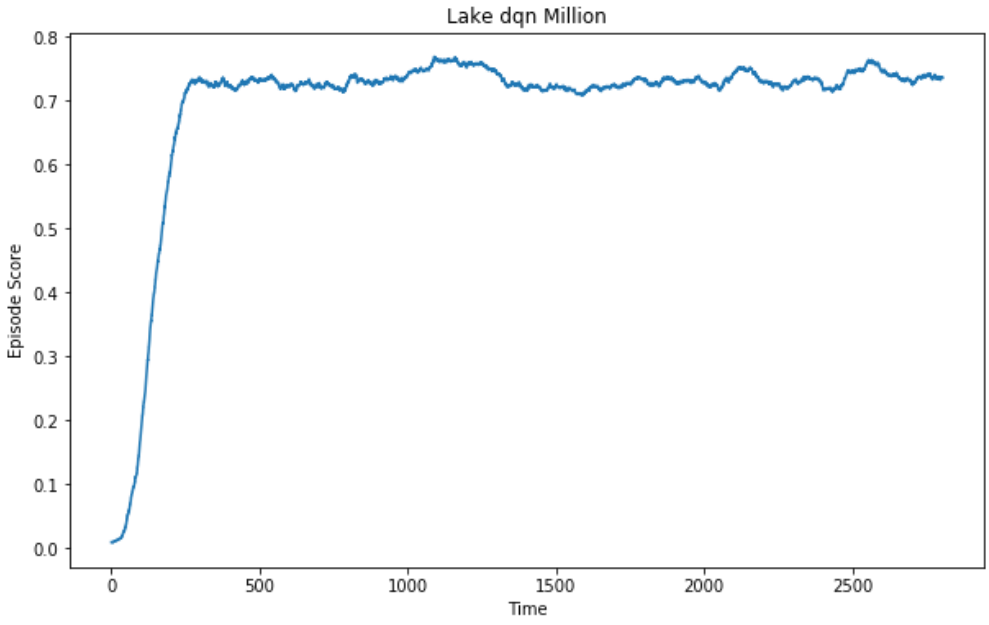
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [95]:
```
# LAKE dqn Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_dqn_million.csv")
lake_dqn_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_data
.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_dqn_time = pd.to_numeric(lake_dqn_million_df.t.values)
dqn_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake dqn Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_dqn_time , dqn_my);

dqn_hy2 = []
for i in range(len(dqn_my) - k):
    num = 0
    for j in range(k):
        num += dqn_my[i+j]
    dqn_hy2.append(num/k)

ax.plot(x_dqn_time[:-k], dqn_hy2);
max(dqn_hy2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

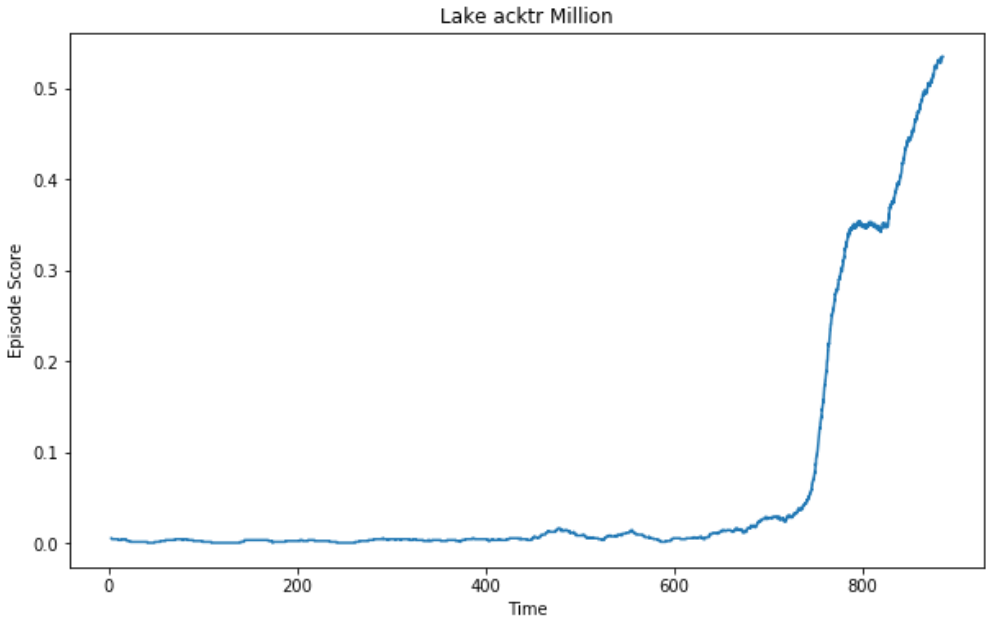
Out[95]: 0.769



In [96]:
```
# LAKE acktr Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_acktr_million.csv")
lake_acktr_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_da
ta.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_acktr_time = pd.to_numeric(lake_acktr_million_df.t.values)
acktr_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake acktr Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_acktr_time , acktr_my);

acktr_hy2 = []
for i in range(len(acktr_my) - k):
    num = 0
    for j in range(k):
        num += acktr_my[i+j]
    acktr_hy2.append(num/k)

ax.plot(x_acktr_time[:-k], acktr_hy2);
max(acktr_hy2)
```

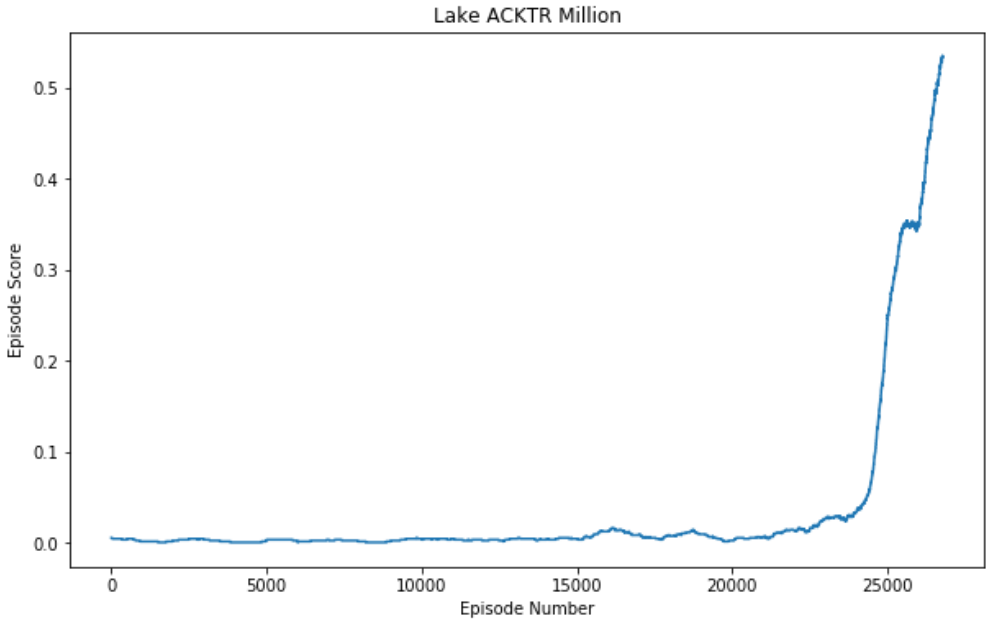
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[96]: 0.535



In [97]:
```
# LAKE ACKTR MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_acktr_million.csv",index_col=False)
lake_acktr_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_da
ta.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_acktr_million_df.index.values)
y = pd.to_numeric(lake_acktr_million_df.r.values)
ax.set_title("Lake ACKTR Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

acktr_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    acktr_my2.append(num/k)

ax.plot(x[:-k], acktr_my2);
#file_data.iloc[0,:].values
```

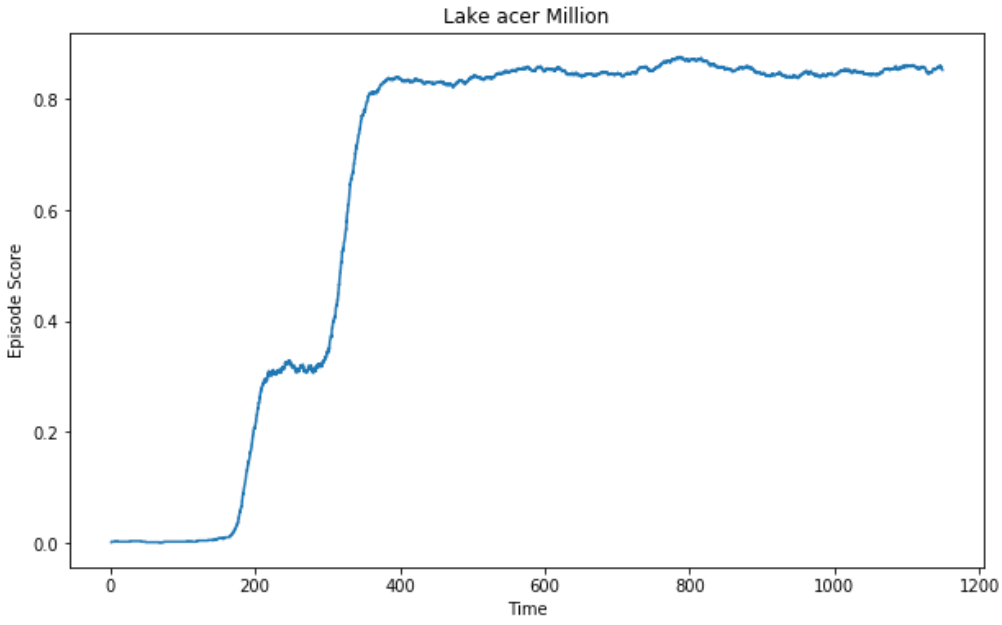
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [98]:
```
# LAKE acer Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_acer_million.csv")
lake_acer_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_acer_time = pd.to_numeric(lake_acer_million_df.t.values)
acer_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake acer Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_acer_time , acer_my);

acer_hy2 = []
for i in range(len(acer_my) - k):
    num = 0
    for j in range(k):
        num += acer_my[i+j]
    acer_hy2.append(num/k)

ax.plot(x_acer_time[:-k], acer_hy2);
max(acer_hy2)
```

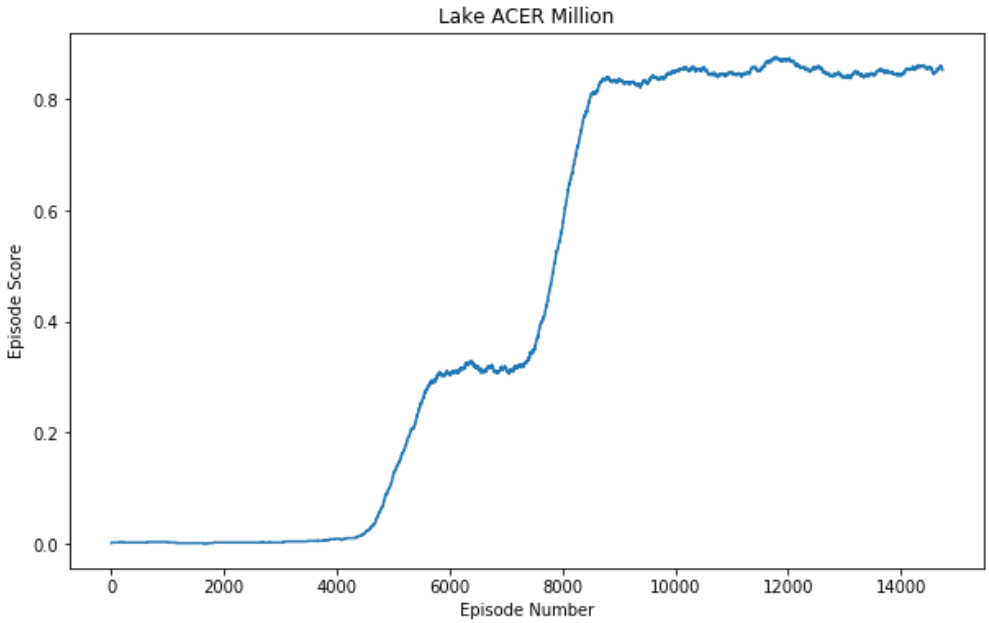
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[98]: 0.877



In [99]:
```
# LAKE ACER MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_acer_million.csv", index_col=False)
lake_acer_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_acer_million_df.index.values)
y = pd.to_numeric(lake_acer_million_df.r.values)
ax.set_title("Lake ACER Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

acer_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    acer_my2.append(num/k)

ax.plot(x[:-k], acer_my2);
```

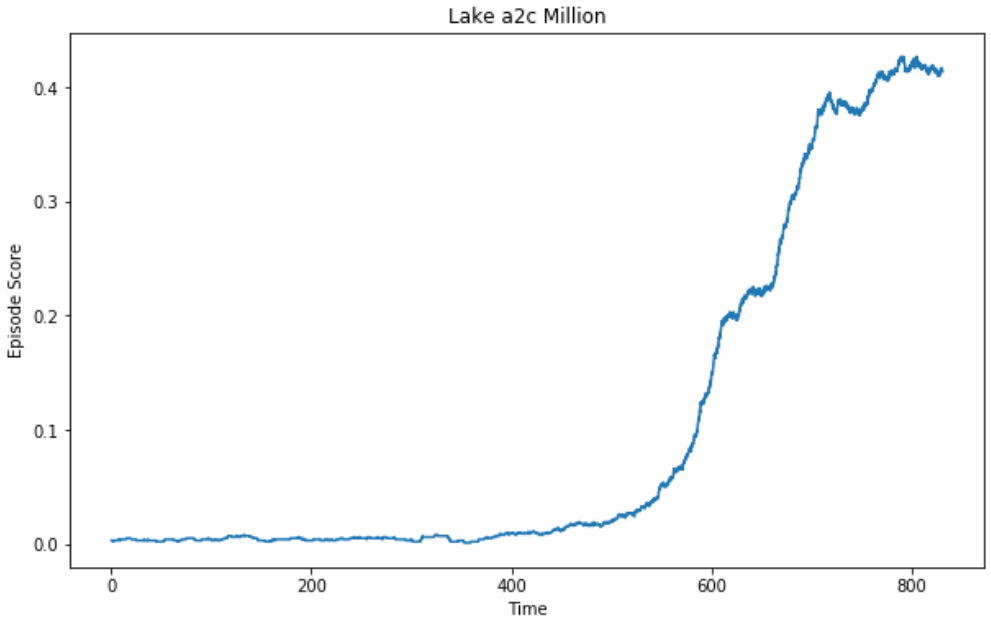
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:6: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
```



In [100]:
```
# LAKE a2c Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_a2c_million.csv")
lake_a2c_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_data
.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_a2c_time = pd.to_numeric(lake_a2c_million_df.t.values)
a2c_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake a2c Million")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_a2c_time , a2c_my);

a2c_hy2 = []
for i in range(len(a2c_my) - k):
    num = 0
    for j in range(k):
        num += a2c_my[i+j]
    a2c_hy2.append(num/k)

ax.plot(x_a2c_time[:-k], a2c_hy2);
max(a2c_hy2)
```

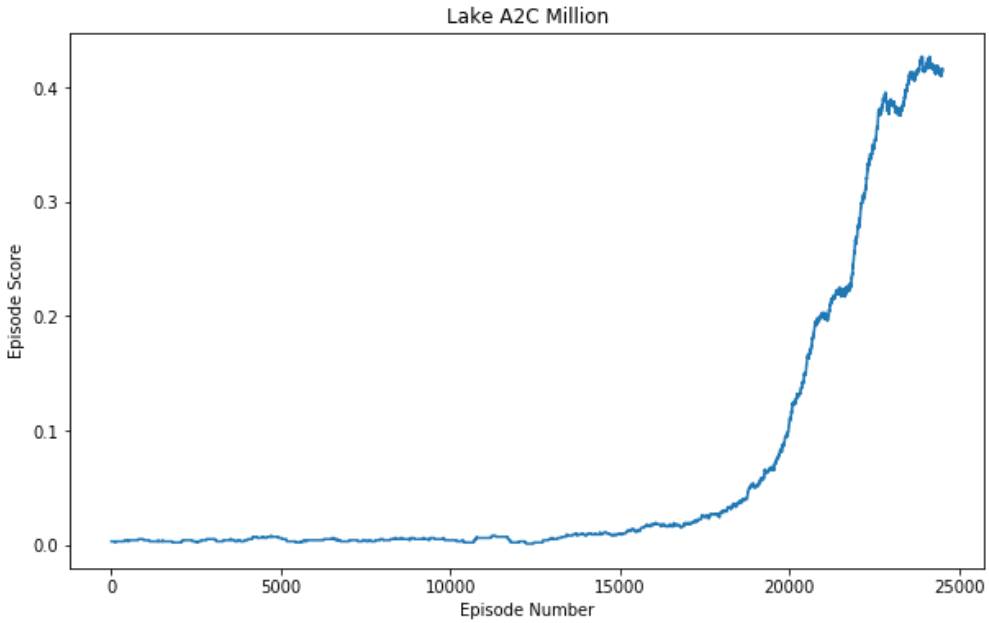
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[100]: 0.427



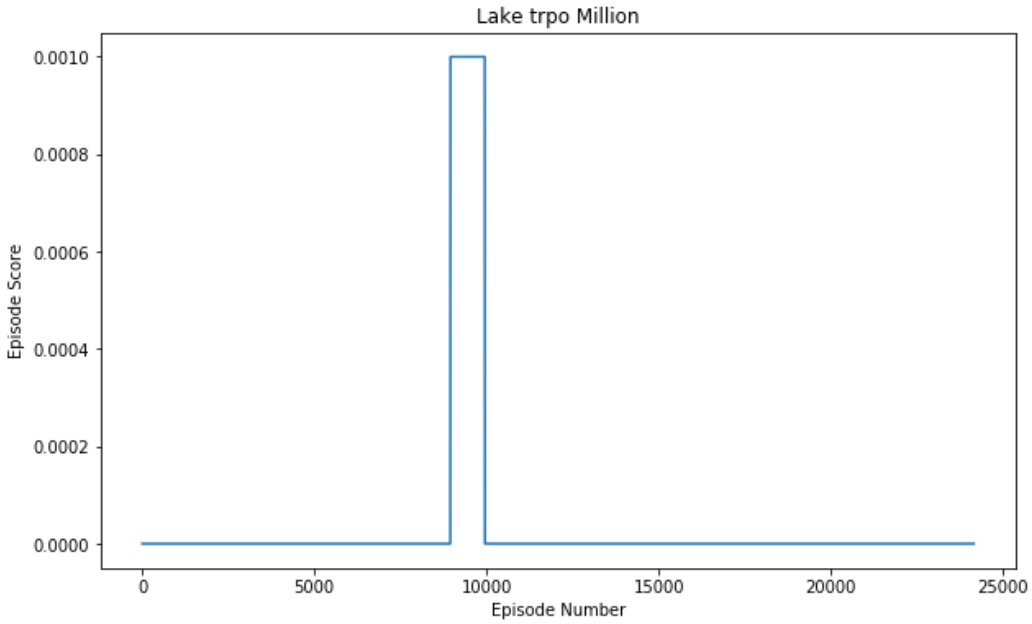
In [101]:
```
# LAKE A2C MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_a2c_million.csv", index_col=False)
lake_a2c_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_data
.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_a2c_million_df.index.values)
y = pd.to_numeric(lake_a2c_million_df.r.values)
ax.set_title("Lake A2C Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

a2c_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    a2c_my2.append(num/k)

ax.plot(x[:-k], a2c_my2);
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [102]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_million.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);
```

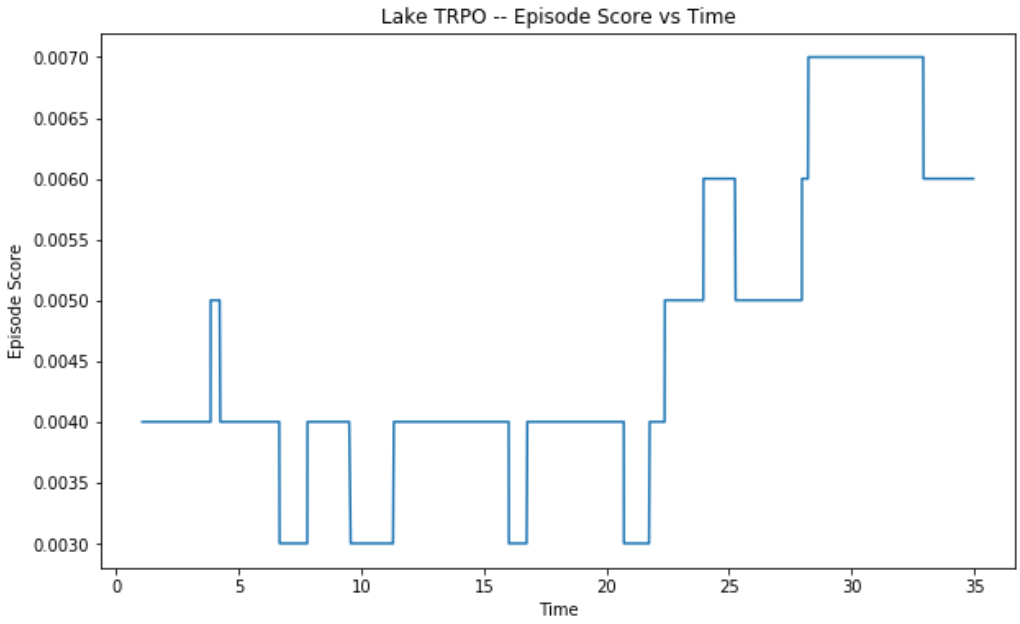
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [103]:
```
# LAKE trpo Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_0005.csv")
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_trpo_time = pd.to_numeric(lake_trpo_million_df.t.values)
trpo_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake TRPO -- Episode Score vs Time")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_trpo_time , trpo_my);

trpo_hy2 = []
for i in range(len(trpo_my) - k):
    num = 0
    for j in range(k):
        num += trpo_my[i+j]
    trpo_hy2.append(num/k)

ax.plot(x_trpo_time[:-k], trpo_hy2);
max(trpo_hy2)
sum(trpo_hy2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

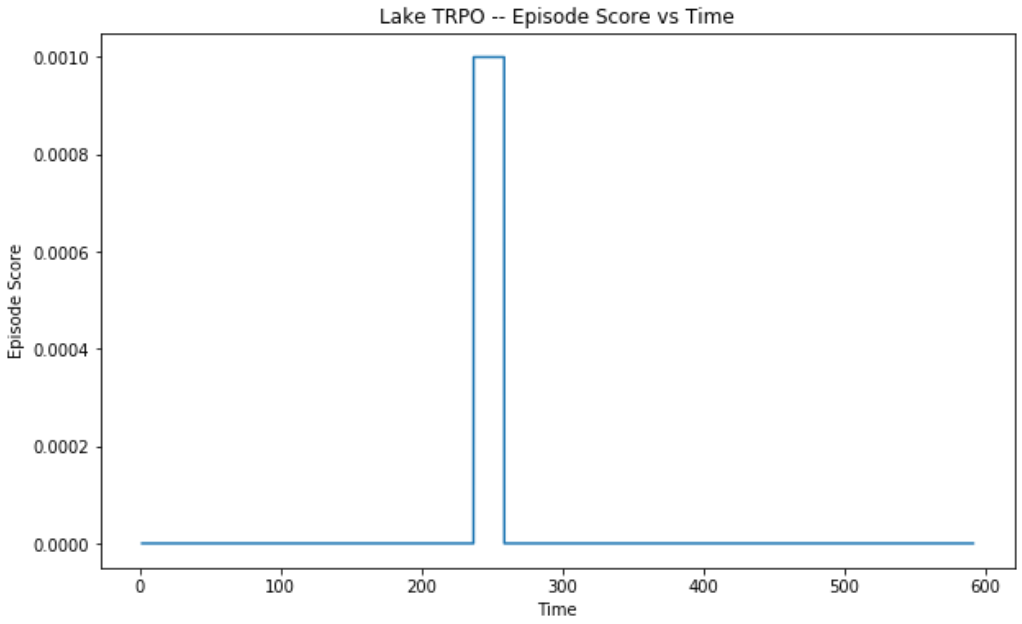
Out[103]: 9.610999999999866



In [104]:
```
# LAKE trpo Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_million.csv")
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_trpo_time = pd.to_numeric(lake_trpo_million_df.t.values)
trpo_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake TRPO -- Episode Score vs Time")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_trpo_time , trpo_my);

trpo_hy2 = []
for i in range(len(trpo_my) - k):
    num = 0
    for j in range(k):
        num += trpo_my[i+j]
    trpo_hy2.append(num/k)

ax.plot(x_trpo_time[:-k], trpo_hy2);
max(trpo_hy2)
sum(trpo_hy2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

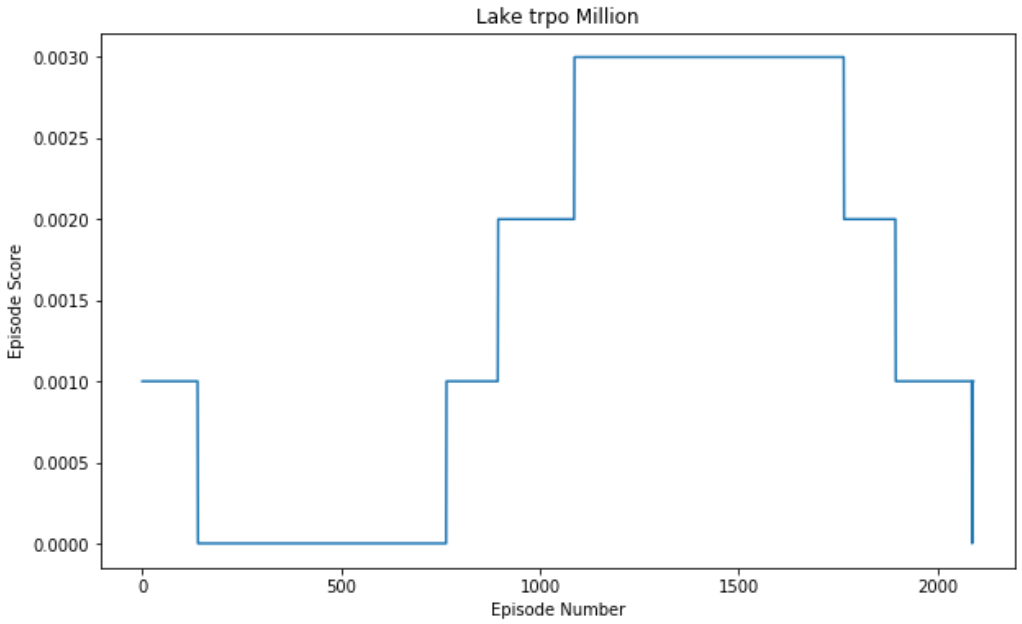
Out[104]: 1.0000000000000007



In [105]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_0001.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);

sum(trpo_my2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

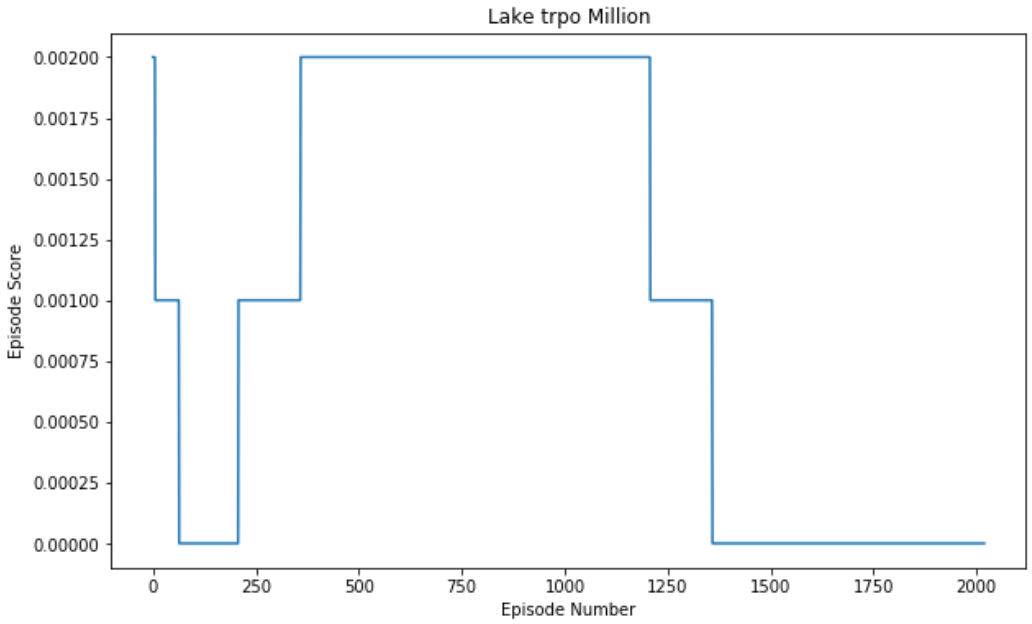
Out[105]: 3.1429999999999407



In [106]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_point7.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);

sum(trpo_my2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

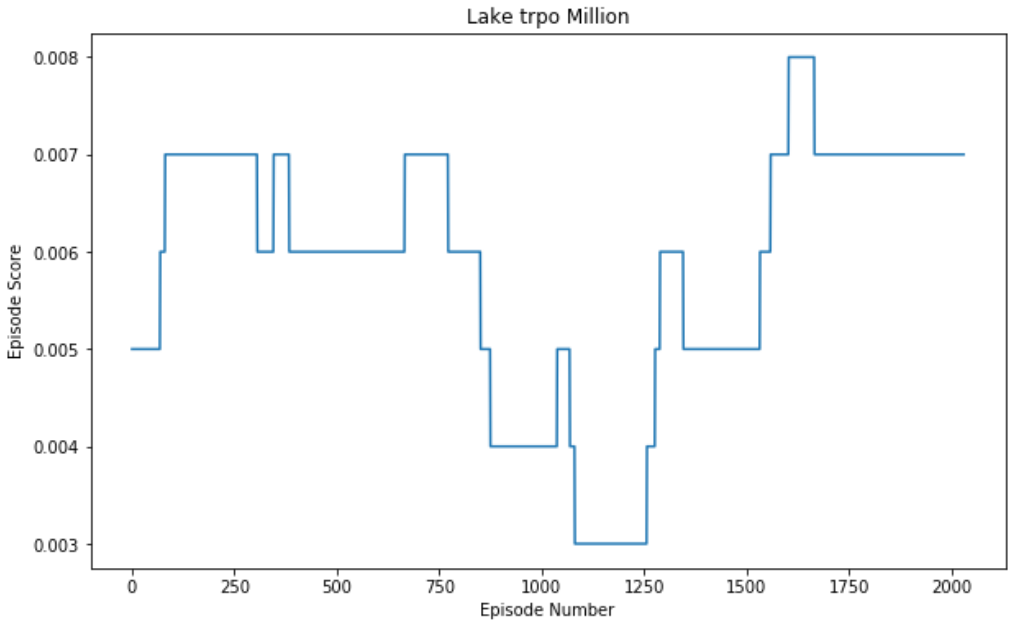
Out[106]: 2.069999999999985



In [107]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_envcoeff_1.csv", index_col=False
)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);

sum(trpo_my2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

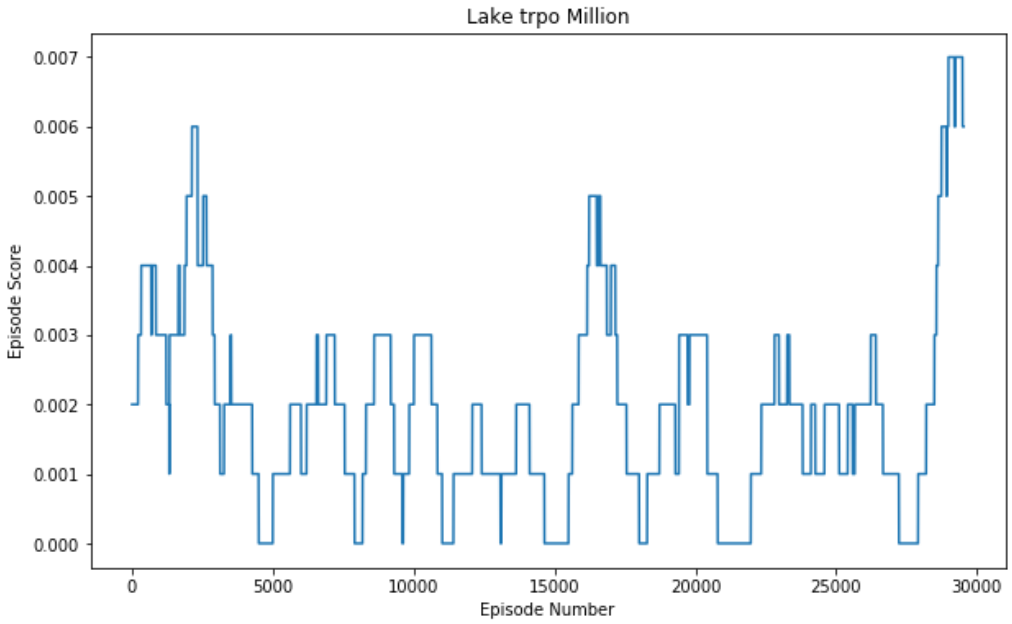
Out[107]: 11.848999999999712



In [108]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_million_1.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);

sum(trpo_my2)
```

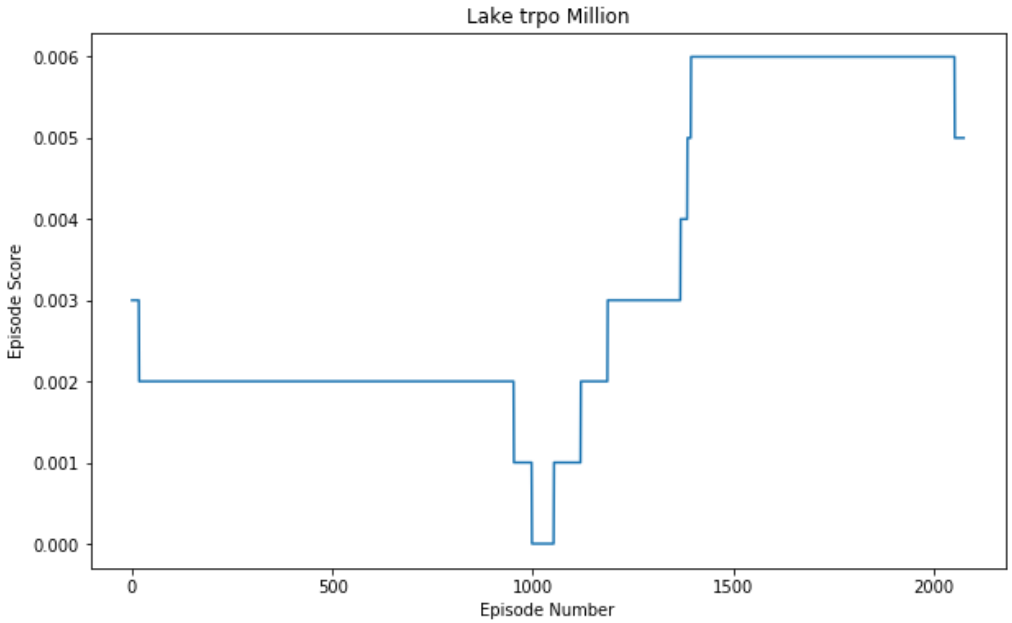
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[108]: 56.634000000002935



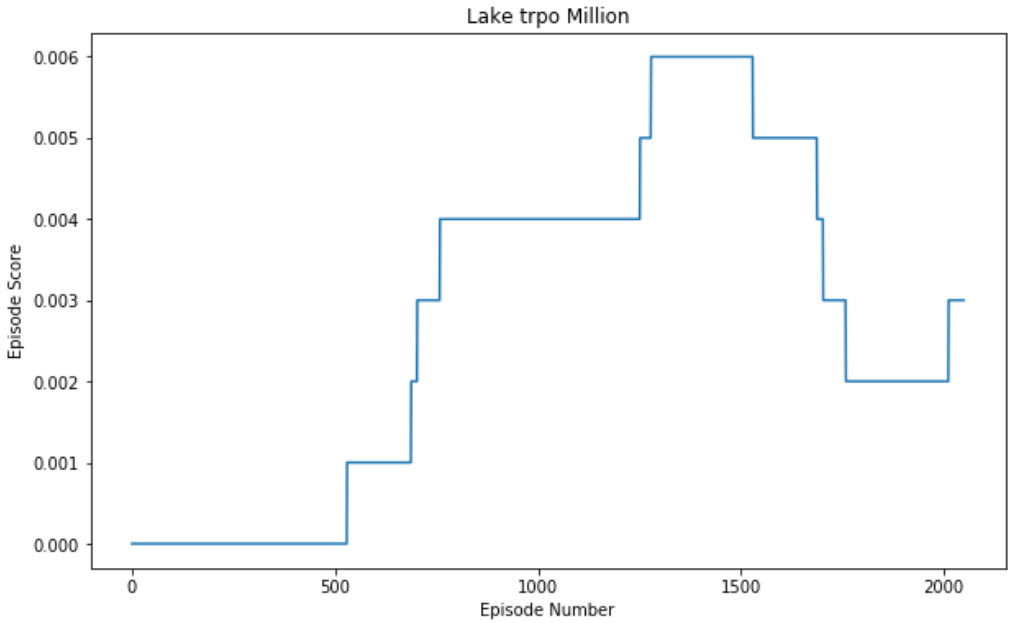
In [109]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_10.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



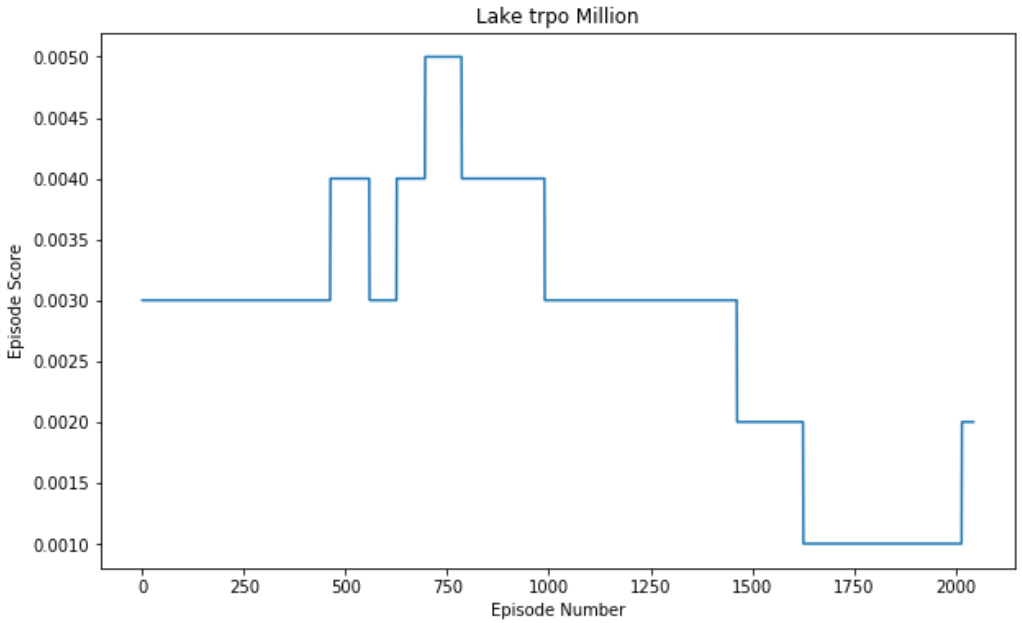
In [110]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_half.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [111]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_100000_2.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);
```

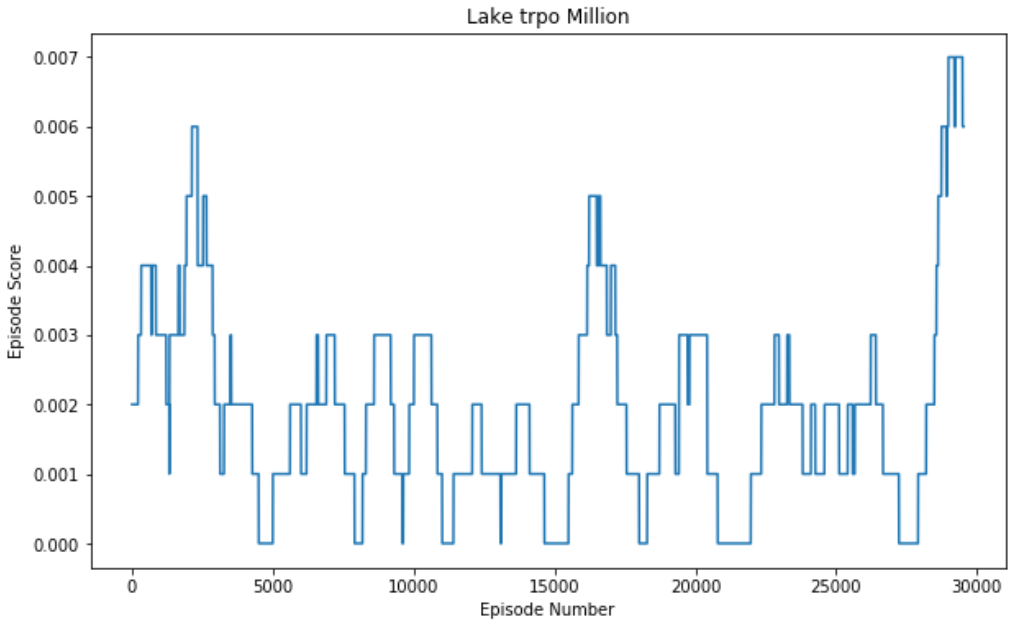
```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```



In [112]:
```
# LAKE trpo MILLION
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_trpo_million_1.csv", index_col=False)
lake_trpo_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_trpo_million_df.index.values)
y = pd.to_numeric(lake_trpo_million_df.r.values)
ax.set_title("Lake trpo Million")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

trpo_my2 = []
for i in range(len(y) - k):
    num = 0
    for j in range(k):
        num += y[i+j]
    trpo_my2.append(num/k)

ax.plot(x[:-k], trpo_my2);

sum(trpo_my2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

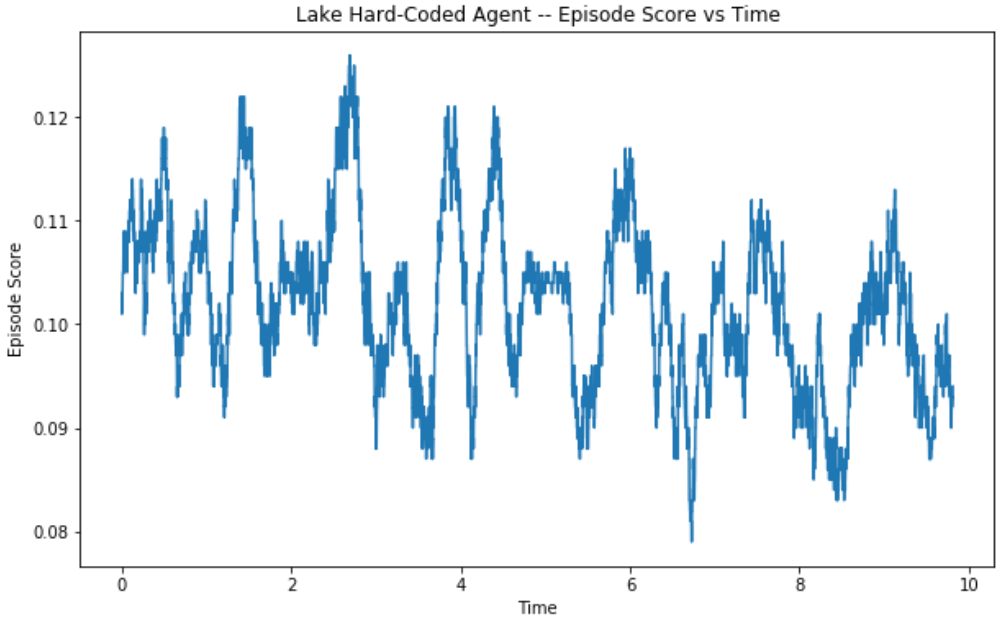
Out[112]: 56.634000000002935



In [113]:
```
# LAKE hardcode Time
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/hardcode_million.csv")
lake_hardcode_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file
_data.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_hardcode_time = pd.to_numeric(lake_hardcode_million_df.t.values)
hardcode_my = pd.to_numeric(file_data.iloc[1:].index.values)
ax.set_title("Lake Hard-Coded Agent -- Episode Score vs Time")
ax.set_xlabel("Time")
ax.set_ylabel("Episode Score")
#ax.plot(x_hardcode_time , hardcode_my);

k2 = 1000
hardcode_hy2 = []
for i in range(len(hardcode_my) - k2):
    num = 0
    for j in range(k2):
        num += hardcode_my[i+j]
    hardcode_hy2.append(num/k2)

ax.plot(x_hardcode_time[:-k2], hardcode_hy2);
max(hardcode_hy2)
sum(hardcode_hy2)/(len(x_hardcode_time) - k2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

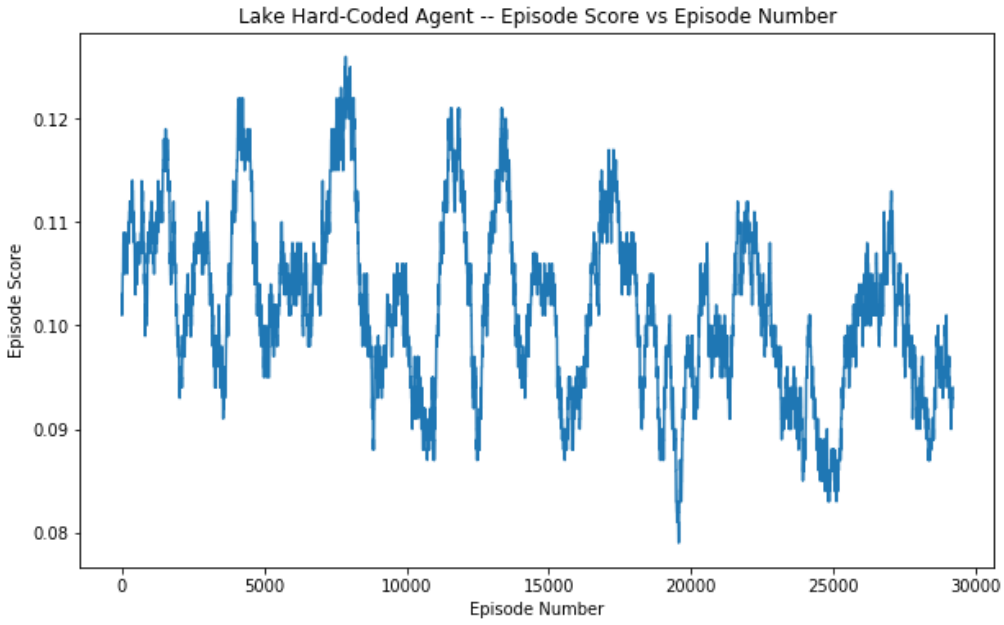
Out[113]:
```
0.10174092341417054
```



In [114]:
```
# LAKE Hardcode Million
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/hardcode_million.csv", index_col=False)
lake_hard_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x_hard = pd.to_numeric(lake_hard_million_df.index.values)
y = pd.to_numeric(lake_hard_million_df.r.values)
ax.set_title("Lake Hard-Coded Agent -- Episode Score vs Episode Number")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

hard_my2 = []
for i in range(len(y) - k2):
    num = 0
    for j in range(k2):
        num += y[i+j]
    hard_my2.append(num/k2)

ax.plot(x_hard[:-k2], hard_my2);
max(hard_my2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[114]: 0.126



In [115]:
```
file_data
```

Out[115]:

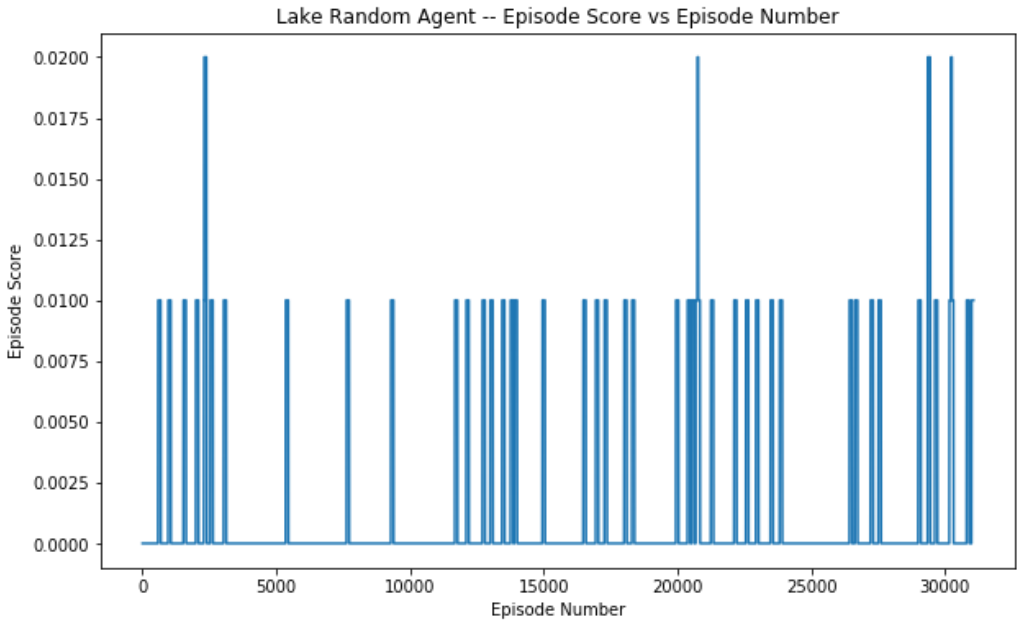
	#{"t_start": 1544997843.343022	"env_id": "FrozenLake8x8-v0"}
0	r	l
1	1.0	57
2	0.0	29
3	0.0	31
4	0.0	36
5	1.0	31
6	0.0	14
7	0.0	63
8	0.0	31
9	0.0	33
10	0.0	27
11	0.0	20
12	0.0	49
13	0.0	45
14	0.0	22
15	0.0	57
16	0.0	24
17	0.0	32
18	0.0	26
19	0.0	17
20	0.0	8
21	0.0	41
22	0.0	34
23	0.0	57
24	0.0	11
25	0.0	9
26	0.0	58
27	0.0	50
28	0.0	32
29	0.0	40
...	...	...
30167	0.0	8
30168	0.0	23
30169	0.0	47
30170	0.0	23
30171	0.0	68
30172	0.0	62
30173	0.0	8
30174	0.0	60

In [ ]:

In [116]:
```
# LAKE trpo 100,000
# Read in File as pandas dataframe
file_data = pd.read_csv("lake/lake_random_million.csv", index_col=False)
lake_rand_million_df = pd.DataFrame(columns= file_data.iloc[0,:], data=file_dat
a.iloc[1:,].as_matrix())

#PLOTTING
fig, ax = plt.subplots(1,1, figsize=(10,6))
x = pd.to_numeric(lake_rand_million_df.index.values)
y = pd.to_numeric(lake_rand_million_df.r.values)
ax.set_title("Lake Random Agent -- Episode Score vs Episode Number")
ax.set_xlabel("Episode Number")
ax.set_ylabel("Episode Score")
#ax.plot(x, y);

k2 = 100
rand_hy2 = []
for i in range(len(y) - k2):
    num = 0
    for j in range(k2):
        num += y[i+j]
    rand_hy2.append(num/k2)

ax.plot(x[:-k2], rand_hy2);

max(rand_hy2)
```

```
/home/mkolor/jupyter_nb_directory/jupyter_nb_env/lib/python3.6/site-packages/ip
ykernel_launcher.py:4: FutureWarning: Method .as_matrix will be removed in a fu
ture version. Use .values instead.
  after removing the cwd from sys.path.
```

Out[116]: 0.02

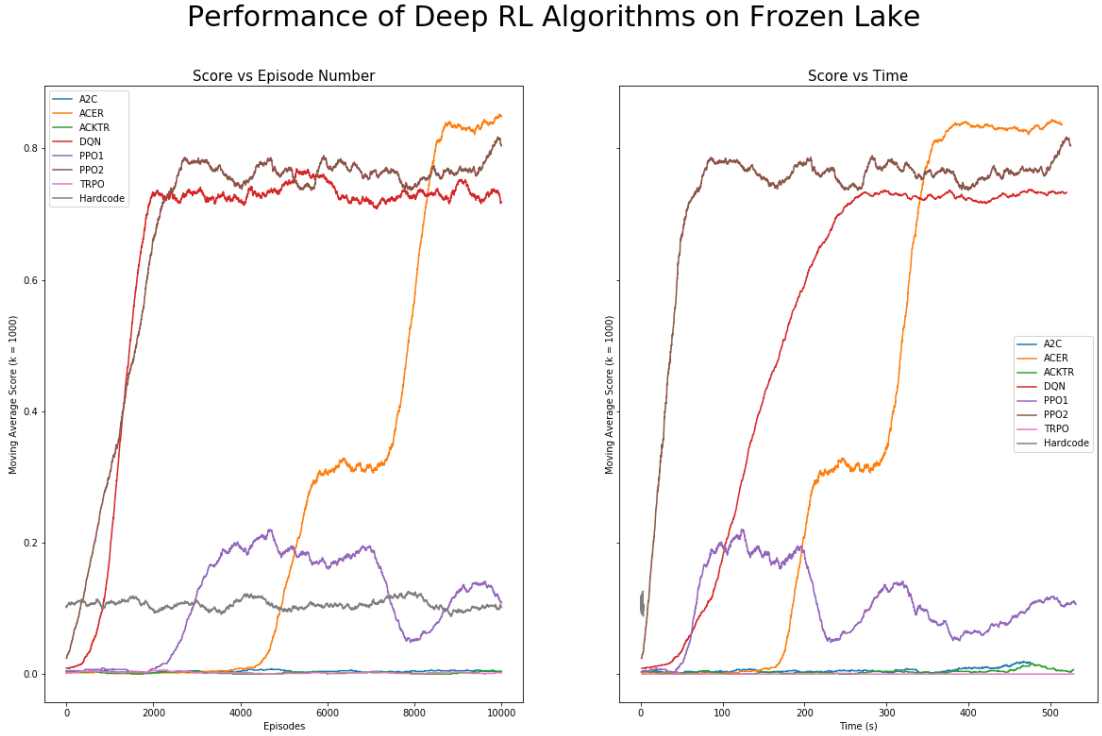


In [117]:
```
file_data
```

Out[117]:

	#{"t_start": 1544998356.0760517	"env_id": "FrozenLake8x8-v0"}
0	r	l
1	0.0	31
2	0.0	46
3	0.0	12
4	0.0	45
5	0.0	30
6	0.0	12
7	0.0	68
8	0.0	36
9	0.0	30
10	0.0	32
11	0.0	51
12	0.0	21
13	0.0	78
14	0.0	159
15	0.0	14
16	0.0	40
17	0.0	31
18	0.0	11
19	0.0	16
20	0.0	19
21	0.0	11
22	0.0	5
23	0.0	44
24	0.0	27
25	0.0	37
26	0.0	47
27	0.0	31
28	0.0	76
29	0.0	45
...	...	...
31133	0.0	7
31134	0.0	11
31135	0.0	21
31136	0.0	10
31137	0.0	22
31138	0.0	35
31139	0.0	54
31140	0.0	22

In [119]:
```
fig_t, ax_t = plt.subplots(1,2,figsize=(20,12), sharey=True)

# MAYBE CHANGE K FOR 100,000

# A2C
ax_t[0].plot(x_m[:10000], a2c_my2[:10000], label="A2C");
ax_t[1].plot(x_a2c_time[:int(len(a2c_hy2)/3*2)], a2c_hy2[:int(len(a2c_hy2)/3*2)
],  label="A2C");

# ACER
ax_t[0].plot(x_m[:10000], acer_my2[:10000], label="ACER");
ax_t[1].plot(x_acer_time[:9700], acer_hy2[:9700], label="ACER");

# ACKTR
ax_t[0].plot(x_m[:10000], acktr_my2[:10000], label="ACKTR");
ax_t[1].plot(x_acktr_time[:int(len(acktr_hy2)*2/3)], acktr_hy2[:int(len(acktr_h
y2)*2/3)],  label="ACKTR");


# DQN
ax_t[0].plot(x_m[:10000], dqn_my2[:10000],  label="DQN");
ax_t[1].plot(x_dqn_time[:3000], dqn_hy2[:3000], label="DQN");

# PPO1
ax_t[0].plot(x_m[:10000], ppo1_my2[:10000], label="PPO1");
ax_t[1].plot(x_ppo1_time[:len(ppo1_hy2)], ppo1_hy2[:], label="PPO1");

# PPO2
ax_t[0].plot(x_m[:10000], ppo2_my2[:10000], label="PPO2");
ax_t[1].plot(x_ppo2_time[:10000], ppo2_hy2[:10000], label="PPO2");

# TRPO
ax_t[0].plot(x_m[:10000], trpo_my2[:10000], label="TRPO");
ax_t[1].plot(x_trpo_time[:int(len(trpo_hy2)/9*8)], trpo_hy2[:int(len(trpo_hy2)/
9*8)], label="TRPO");

# Hardcode
ax_t[0].plot(x_hard[:10000], hard_my2[:10000], label="Hardcode");
ax_t[1].plot(x_hardcode_time[:10000], hardcode_hy2[:10000], label="Hardcode");

ax_t[0].set_xlabel("Episodes")
ax_t[1].set_xlabel("Time (s)")
ax_t[0].set_ylabel("Moving Average Score (k = {0})".format(k))
ax_t[1].set_ylabel("Moving Average Score (k = {0})".format(k))


ax_t[0].legend();
ax_t[1].legend();

fig_t.suptitle("Performance of Deep RL Algorithms on Frozen Lake", fontsize=30)
;
ax_t[0].set_title("Score vs Episode Number",fontsize=15)
ax_t[1].set_title("Score vs Time", fontsize=15);

plt.savefig('CleanedPlots/lake_adjust.png')
```


Performance of Deep RL Algorithms on Frozen Lake
Score vs Episode Number
Moving Average Score (k = 1000)
Episodes
A2C
ACER
ACKTR
DQN
PPO1
PPO2
TRPO
Hardcode
Score vs Time
Moving Average Score (k = 1000)
Time (s)

In [ ]:

In [ ]:

In [ ]: