Stat753_HW11_JaleesaHoule

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[4]:
```
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

0.1 Take a standard Brownian motion W. Find the probability that its maximum over [0,9] is greater than 5, and $W(9) > 1$.

[5]:
```
def brownian_motion_sim( dt, T, mu=0, sigma=1, x0=None):
    N = int(T/dt)
    BM = np.append(np.zeros(1),np.cumsum(np.random.normal(mu*dt, sigma*np.
 ↪sqrt(dt), N)))
    if x0 is not None:
        BM= np.cumsum(np.append(x0, np.random.normal(mu*dt, sigma*np.sqrt(dt),␣
 ↪N)))
    time = np.linspace(0,T, N+1)

    return BM, np.round(time,2)

def find_value_at_T(values,jumptimes, T):
    idx = np.where(jumptimes == T)[-1][-1]
    return values[idx]
```

[6]:
```
dt = 0.01
N = 10000
T=9
sims=[]
np.random.seed(1000)
for i in range(N):
    a,b = brownian_motion_sim(dt, T)
    sims.append(a)
    time = b
```

[9]:
```
countw_9 = 0

sims_idx=[]
for i in range(N):
    w_9 = find_value_at_T(sims[i], time, 9)
```

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    if (np.max(sims[i][:900])>5) and (w_9>1):
        countw_9+=1
```

[10]:
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print('P(M(9)>5, W(9)>1)=', countw_9/N)
```

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P(M(9)>5, W(9)>1)= 0.0912
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[ ]:
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