

$$\begin{aligned}
 X_{s+h} - X_s &= \mu(s+h) + \sigma B_{s+h} - \mu s - \sigma B_s \\
 &= \mu h + \sigma (B_{s+h} - B_s) \sim \mu h + \sigma B_h
 \end{aligned}$$

DIFFERENCE IN BASEBALL SCORES ($\overset{= X_A}{\text{HOME TEAM MINUS AWAY TEAM}}$)
 MODELLED AS BROWNIAN MOTION WITH A DRIFT.

$$\mu = 4.87, \quad \sigma = 15.82, \quad A = 1 \text{ FULL GAME} \quad X_A = \mu A + \sigma B_A$$

QUESTION: IF SCORE IS -5 AT $t = 0.5$ WHAT IS PROBABILITY
 OF WINNING FOR HOME TEAM?

$$\begin{aligned}
 P(X_1 > 0 | X_{0.5} = -5) &= P(X_1 - X_{0.5} > 5) = P(X_{0.5} > 5) = P\left(\frac{\mu s}{\sigma} + \sigma B_{0.5} > 5\right) \\
 &= P(B_{0.5} > \frac{5 - \mu/2}{\sigma}) = 1 - \text{pnorm}\left(\frac{(5 - 4.87/2)}{15.82}, 0, \sqrt{0.5}\right)
 \end{aligned}$$