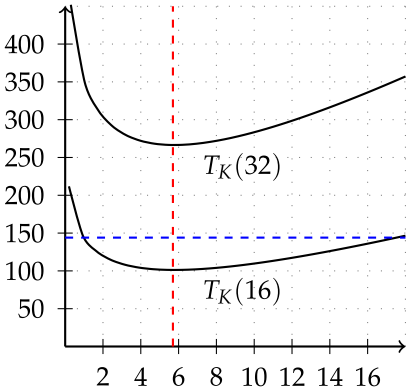
- Deriving an optimal value of K for hybrid sort



$$\frac{\partial T_K(N)}{\partial K} = \frac{-2N}{K \cdot \ln(2)} + \frac{1}{2}N = 0$$

$$\frac{2N}{K \cdot \ln(2)} = \frac{1}{2}N$$

$$\frac{2}{K \cdot \ln(2)} = \frac{1}{2}$$

$$\frac{4}{K \cdot \ln(2)} = 1$$

$$K = \frac{4}{\ln(2)}$$

$$K = 5.77$$

- Deriving a break-even value of K for merge sort vs. hybrid sort

$$2N \cdot \log_2(N) + N = 2N \cdot \log_2(N) - 2N \cdot \log_2(K) + N(\frac{1}{2}K + \frac{1}{2})$$

$$N = -2N \cdot \log_2(K) + N(\frac{1}{2}K + \frac{1}{2})$$

$$1 = -2 \cdot \log_2(K) + \frac{1}{2}K + \frac{1}{2}$$

$$\frac{1}{2} = -2 \cdot \log_2(K) + \frac{1}{2}K$$

$$1 = -4 \cdot \log_2(K) + K$$

- Solve numerically to find $K = 17.52$
- If $K < 17.52$, then hybrid sort is faster given this simple model
- Can use real experiments to derive similar optimal and break-even values for K either analytically or empirically