Probability (Linearity of Expectation)

- **QuickSort / Selection Sort**
  - Random variable is \# of comparisons over alg
    - integer that depends on choice of pivot at each step
  - \( X = \sum X_{i,j} \) \[ \rightarrow \] \( E[X] = \sum \sum E[X_{i,j}] \)
    - \( total \) \( \uparrow \) \( \# \) times \( X_{i,j} \) compared
    - \( X_{i,j} \) is indicator
    - \( E[X_{i,j}] = Pr[C_{i,j} \text{ event occurs}] \)

- **Random Search**
  - Random variable is \# of rounds
    - integer that depends on choice of query at each step
  - Break into stages
    - \( X = \sum X_i \) \[ \rightarrow \] \( E[X] = \sum E[X_i] \)
    - \( total \) \( \uparrow \) \( \# \) of steps in \( i^{th} \) stage
  - Break each stage into indicator random variables for each round