Risk Management

http://lbgeeks.com/gitc/pmRisk.php

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Outline

- **What is Risk Management?**
- **Probability and Risk**
- **Statistics and Distributions**
- **Monte Carlo Simulations**
- **Critical Path Convergence**
- **Risk Decision Trees**
- **Summary**

What is Risk Management?

- **Risk is potential adverse change:**
  - **Positive change, improvements, beneficial**
  - **Negative change, detriments, harmful**
- **Risk can be measured:**
  - **Probability mathematics**
  - **Statistical analysis**
- **Risk may be reduced:**
  - **Changes to project process or structure**
  - **Resource redundancy and back-up systems**
- **We must measure cost of risk and spend appropriately when warranted**

Probability

- **Odds of something happening:**
  - **Floating point number from 0.0 to 1.0**
  - **0.0 = will never happen**
  - **1.0 = must always happen**
- **Heads or tails has probability of 0.5**
- **Two boys has probability of 0.25**
- **Random outcome means no single result is more or less likely then another**

Risk

- **Risk has several loss related factors:**
  - **Probability, from 0.0-1.0**
  - **Monetary cost**
  - **Human perception**
- **Cost is loss probability × amount**
  - **Spend 1K to avoid 1% probable 1M loss?**
  - **Spend 10K to bid 10% probable 1M job?**
- **Types of monetary loss:**
  - **Actual**
  - **Unrealized**
  - **Opportunity**

Statistics and Distributions

- **Linear Tranformations**
- **Standard Deviation and Variance**
- **Triangular and Beta Distribution**

Linear Tranformations

- **Convert vector to scalar via defined summation or selection**
- ***Mean* is the sum of all data set members divided by the number of samples**
- ***Median* is the data set member where cardinally half are more and half are less**
- ***Mode* is the most often repeated member**
- **See “How to Lie With Statistics,” Darrel Huff, first published in 1954**

Linear Transformation Example

Compute the mean, median, and mode for the above data set

Variance

- **Measure of statistical dispersion**
- **Squared difference between a data point and the average:**
  $\sigma^2 = (x_i - \mu)^2$
- **Always positive**
- **Used to compute the standard deviation**

Standard Deviation

- **Root mean square variance of a function from its arithmetic mean**
- **Example: AC RMS voltage of sine wave**
- **Average squared difference from mean: $\sigma = \sqrt{(n^{-1}\sum\sigma_i^2)}$**
- **Measures dispersion of data set**
  - **Small = data points are close to mean**
  - **Large = far from mean**

Triangular And Beta Distributions

- **Given three cases, worst, average, best, what is most likely?**
- **Triangular is straight average:**
  - **(w + a + b) / 3**
  - **Assumes any outcome is equally likely**
- **Beta is weighted average:**
  - **(w + 4a +b) / 6**
  - **Assumes average outcome is more likely**
- **Beta makes more sense for projects with better data collection, more experience**

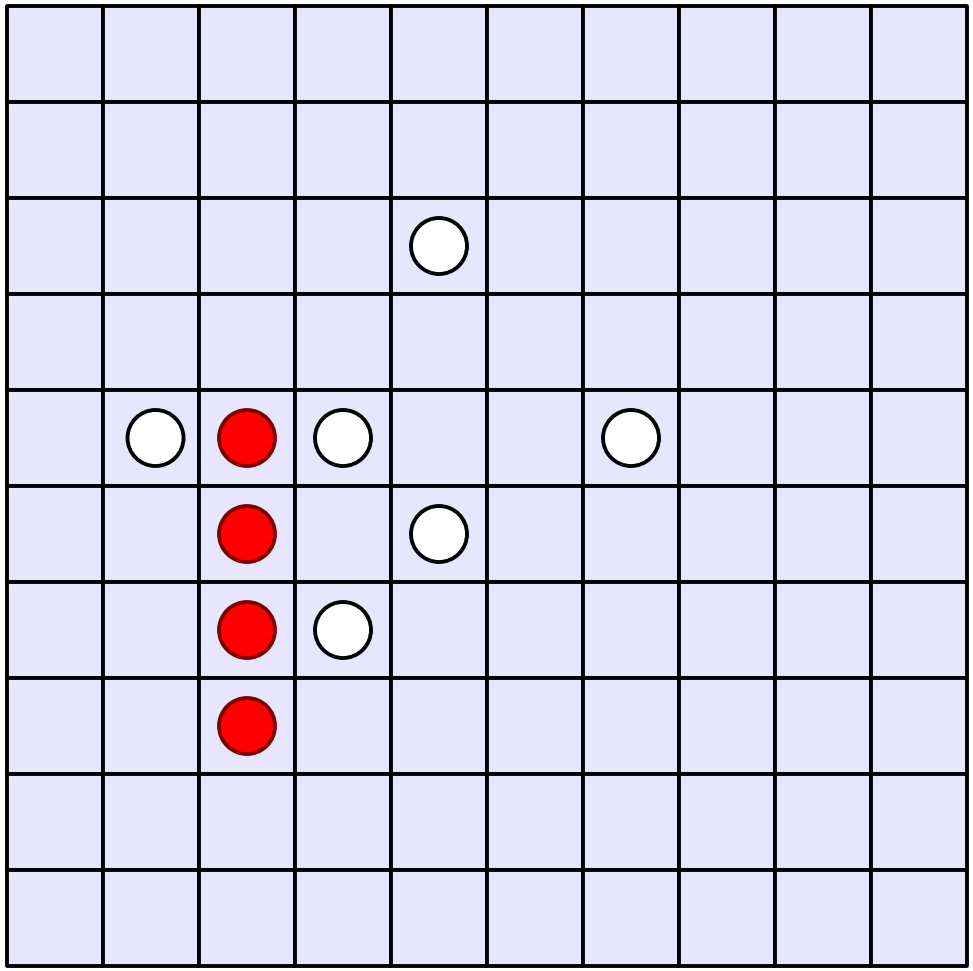
Application to Risk Management

- **For each task in a project, determine w, a, b costs in money and time**
- **Beta distribution to compute project total**
- **Standard deviation to assess risk: higher deviation means higher risk**
- **Monitor deviation throughout project to spot increasing risk early**

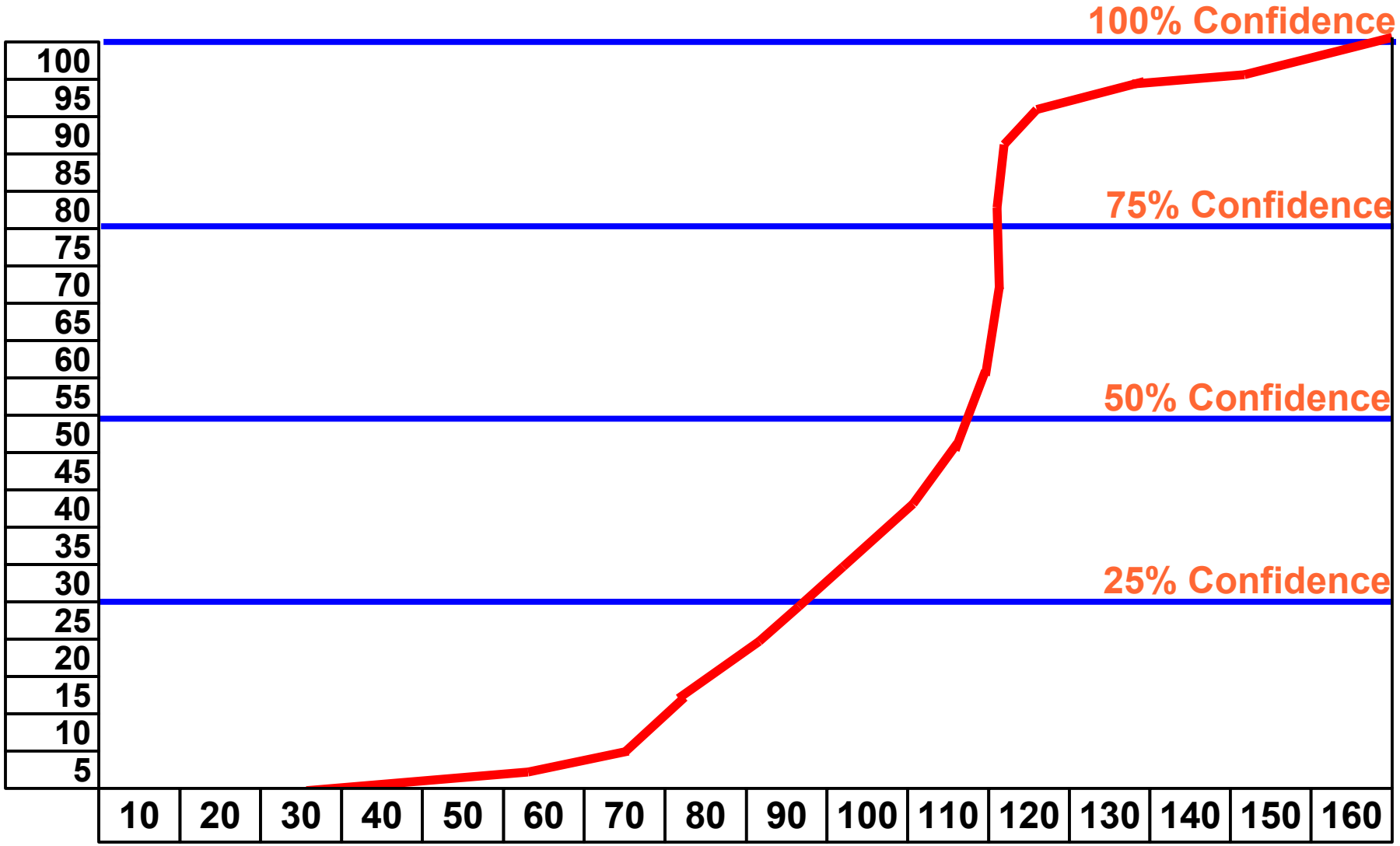
Monte Carlo Simulation

- **Generate huge volume of input test cases using random numbers:**
  - **Estimate using traditional methods**
  - **Generate variances randomly**
- **Drive simulation using cases**
- **Analyze where output converges**

Monte Carlo Example – 1 of 2



Monte Carlo Example – 2 of 2



Project Duration, Days

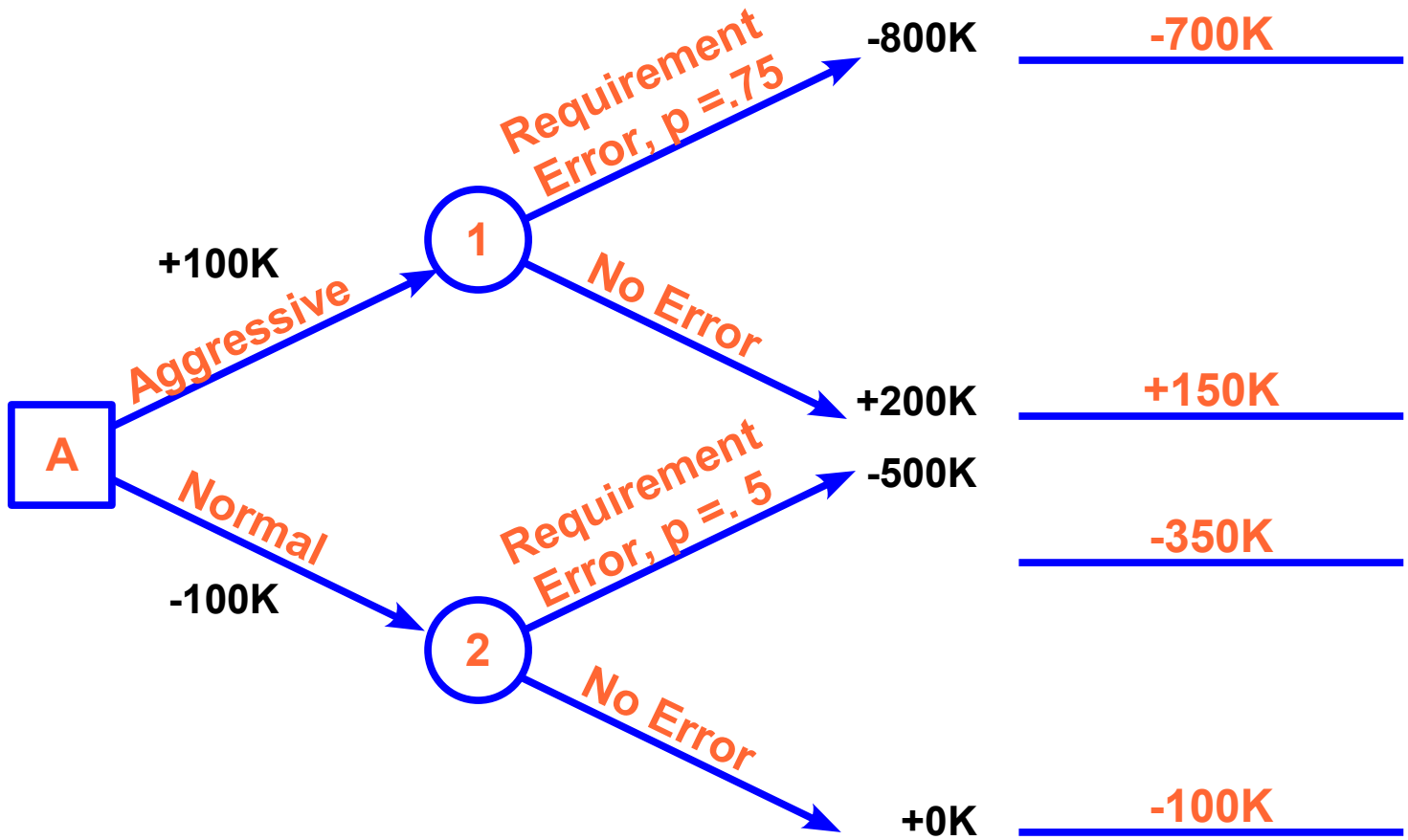
Critical Path Convergence

- **Computations hold when all paths stable**
- **Exceeding critical path may propagate more delays:**
  - **Makes tasks on other paths late**
  - **These paths then become critical**
  - **Resuming schedule on original critical path still results in project delay**
- **Need to compute what happens if all paths in the network are exceeded**
- **Major benefit of Monte Carlo simulation**

Risk Decision Trees

- **Two results of every decision:**
  - **Known impact of taking a specific path**
  - **Random outcome of future events**
- **Random outcomes have associated probability and monetary value**
- **Diagram impact of decision by showing outcome of all possible cases**
- **Can then make more informed decision**

Risk Decision Tree Example



Summary

- **Change has up and down side**
- **Risk is measurable, quantifiable**
- **Mathematics are available to help evaluate risk over total project**
- **Subjective evaluation also needed, varies for different people and projects**