Most Significant Concepts

ISE 453: Design of PLS Systems — Spring 2020

The following represents the most significant concepts covered in this class, listed in order of decreasing significance, where the significance of each concept is determined by its importance and nonobviousness: *significance* = *importance* × *nonobviousness*

1. **Level of analysis:** use the simplest (*least costly*) analysis necessary to select between multiple alternatives, taking into account the *time* of the analyst

2. **Savings-based payback:** operating cost savings can be used as profit to determine the payback of additional investment

$$Payback\ period = \frac{IV_{\text{new}} - SV_{\text{current}}}{OC_{\text{current}} - OC_{\text{new}}}$$

3. **Little's Law:** for any production system in steady state, knowing any two allows the third to be determined

$$TH = \frac{WIP}{CT}, \quad CT = \frac{WIP}{TH}, \quad WIP = TH \cdot CT$$

4. **Discounting:** one-time investment costs and salvage values are made commensurate with per-period operating costs via discounting

$$IV^{\text{eff}} = IV - SV\left(1+i\right)^{-N}, \quad K = IV^{\text{eff}}\left[\frac{i}{1-(1+i)^{-N}}\right], \quad AC = \frac{K+OC}{q}$$

5. **Buffering:** only three possible kinds of buffers are used to deal with demand variability in a production system:

Capacity, *Time*, and *Inventory*

6. **Rounding** (365.25 days/year): only round when determining concrete events or entities; otherwise, always keep fractional value (Use of a year as the time period is arbitrary and we could have used a month or week and all we would have to do is scale the data. By not rounding, we get the same result; with rounding, the results would differ a bit for each different time period. So not rounding keeps all information.)

7. **Guesstimation** (Fermi problems): used to provide an estimate within an order of magnitude of correct answer; usually easy to estimate a lower bound (assume perfect control) and practical upper bound (no control) of a parameter *X*:

$$\text{Geometric Mean: } X = \sqrt{LB \times UB}$$

8. **Monetary vs. physical weight:** a production process can be physically weight *losing* $\left(\Sigma f_{\text{in}} > \Sigma f_{\text{out}}\right)$ but monetarily weight *gaining* $\left(\Sigma w_{\text{in}} < \Sigma w_{\text{out}}\right)$

9. **Load density:** freight capacity is determined by both the *weight* and *cube* of a load

10. **Warehouse design:** design of any warehouse involves a tradeoff between minimizing *building* costs (maximizing cube utilization) and minimizing *handling* costs