



Instructions for Using the Variability Simulation Spreadsheet

The spreadsheet file "3-2 AP VariabilitySim APv7.xls" accompanies Slides 15-20 in Module 3-2 and may be used for live simulations the performance of the accounts payable system due to variation of input arrivals and process performance. The sim tracks inventory at each in-box (triangles). It calculates average jobs completed per day, WIP, and cycle time after 20 and 216 days. The plot shows the Inventory at each station by day for the 216 days. Note that every result is different and there is no steady pattern. The "Luck" box is described below.

1. Open the spreadsheet.
2. Hit the Control OR the Command & = buttons to execute a simulation
3. Pink cells have pull down menus that allow you to change the die table. Options include lowering variability (30% less variability is a die with no 1's or 6's, 70% less variability has only 3's and 4's), decreasing average 10, 20 or 30 % while maintaining the same coefficient of variation (these are rather odd dice), and eliminating all variation while lowering average by 23% (only 3's)

The notes below go with each slide:

Slide 15 – Usually, the sort of pattern seen here appears - jobs/day climb as the WIP grows (intuitively, as all of the inboxes fill, no capacity is ever lost to the die roll being greater than the inventory) but the cycle time gets terrible. The "luck" box is just a check on the random number generator - in this case, at 20 days, luck may make some difference (the computer generated die rolls have run 10% below expected average); by 216 days the bad luck continues but only accounts for 4% of the results, not enough to say that the mess we are seeing is due to "bad luck". Usually the luck factor is even less significant (1-2%) as the computer rolls A LOT of simulated dice.

Slide 16 - A bottleneck is created by having PFR Check have 30% less capacity. Masses of inventory accumulate there; WIP and Cycle Time grow without limit. Note this is subtle; Accounts Payable indeed does not have this sort of monster bottleneck.

Slide 17 - Reducing input variation by 30% helps a little... Its also worth trying a fully predictable and lower average input (all 3s) and a random but lower input level (select one or more of the reduced averages at the Customer) - these help even more, but do not make the variability go away. Note to the students that reducing input variability 70% is less effective than reducing its average by 30 or even 20% - we will see why soon.



Slide 18 - Reducing input level helps a lot – The inventory still has high variation (as seen by the zig-zag levels) it no longer grows without limit. They cycle times are much improved, but the Invoices/day are down.

Slide 19 - Reducing variability EVERYWHERE helps a lot, although inventory and cycle time due still tend to creep up.

Slide 20 - Finally, when customer demand is leveled AND variability is low, “perfection” is reached - a flow system!

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