4-18-2012

Exploring the Job Shop Queuing Environment

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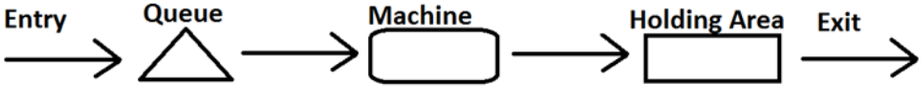
Abstract

The job shop is an environment in manufacturing where jobs arrive randomly and take a random amount of time to complete. For instance, a maker of specialized metal parts most likely involves some sort of job shop. The job shop can also represent a bottleneck in a larger manufacturing process. The main obstacle in the job shop is the queue of jobs waiting to be worked upon. The trick is to order the queue so as to perform the jobs to optimize for various metrics. These metrics vary and involve measurements from average time in shop to the aggregate lateness of the jobs. My research explores the repercussions of sequencing the jobs using various queueing rules under a variety of conditions.

Single Machine Job Shop



Introduction

Queueing is a very practical aspect of operations research. It is often hard for a company to determine the optimal way to schedule the tasks to be performed. The goal of this scheduling is to optimize performance for some metric, usually lateness. Other important metrics revolve around how long each job is in the shop. Some of the variables that affect job shop environments include the utilization level, how due dates are set for tasks, and whether a job completed before its due date is allowed to leave the job shop.

Approach

To carry out my research I created a simulation of a single machine job shop environment using ARENA simulation software. Into this model I built 4 queueing rules: SPT, EDD, MODD, and CR. I ran this model 72 times using different levels of utilization, different due date levels, and allowing early release in half of the tests. I then compiled the results into a series of spreadsheets in order to analyze the results.

Results

	Max Flow Time	Flow Time Variability	Average Flow Time	Max Lateness	Average Lateness	Fraction Tardy
SPT		9	12		9	7
EDD	12	2	2	15	6	10
MODD		6	3	3	3	1
CR	6	1	1			

My results provide an insight into how these queueing rules perform on the metrics I measured under each of the sets of circumstances. These results could be used by companies seeking to optimize their own schedules.