Module 8:Application of stochastic processes in areas like scheduling

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Application of stochastic processes in areas like scheduling

Production systems include many sources of uncertainty and they are several ways how randomness can be incorporated in the system. In order to study these we need to make some valid assumptions as well understand the nomenclature for the same. Hence for job j the following variables/nomenclatures are used and they are as follows:

1. $X_{i,j}$ = Random processing time for the j^{th} job in the i^{th} machine
2. $\frac{1}{\lambda_{i,j}}$ = Mean or expected value of the random variable $X_{i,j}$
3. C_j = Random completion date of j^{th} job
4. R_j = Random release date of j^{th} job
5. D_j = Random due date of j^{th} job
6. w_j = Weight or importance assigned to j^{th} job

Application of stochastic processes in areas like scheduling

1. Whatever the distribution of processing be, they can be classified according to completion rate, $C(t)$, which can be increasing completion rate (ICR), decreasing completion rate (DCR) or constant completion rate (CCR). From the names it is obvious that the completion rate of the function increases, decrease or remains constant with respective to time t. Relevant examples of such distributions are Erlang, mixture of exponential and exponential respectively.
2. The other important concepts which are important for studying stochastic scheduling problems is stochastic dominance based on expectation and stochastic dominance based on variance.

Classes of Policies

In stochastic scheduling policies certain definition and concepts need to be made clear and they are as follows

1. ***Nonpreemptive static list policy*** : Here the decision maker orders the job at time $t = 0$ according to a priority list. One should remember the priority list does not change during the evaluation of the process, and every time a machine is freed, the next job in the list is selected for processing.
2. ***Nonpreemptibive dynamic policy*** : Under this policy, every time a machine is freed the decision maker is allowed to determine the job which goes next. The decision of the person depends at that time on the set of information available to him/her which may be the jobs waiting to be processed, the priority list, the amount of processing the jobs have already received in machines, etc. It should be remembered that once a job has started the decision maker is not allowed to stop the processing of the job until and unless it is completed.
3. ***Preemptibive dynamic policy*** : For this policy the decision maker can decide at any point of time which jobs should be processed on the machines. It is true that he/she will have the information related to priority list, the amount time need for processing jobs in machines, etc. Yet the decision maker can take his/her decision related to the sequencing of the jobs in the machines and that changes dynamically.

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