Global Journal of Researches in Engineering: G
Industrial Engineering
Volume 14 Issue 1 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

A Solution for the Scheduling Problem in a Multi-Plant and Multi-Product Environment

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Abstract- Scheduling is an important tool for manufacturing and engineering, where it can have a major impact on the productivity of a process. In this paper, we use flow shop scheduling in KCCL (Kohinoor Chemical Company Limited) & find out the optimum policy in scheduling operating several machines to produce soap & to reduce idle time of machines. Considering different type of machine that also absorbs different production time. The industry tries to identify their idle time & best presidential relationship between the machines. We use Johnson's scheduling algorithm & a numerical output is achieved.

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GJRE-G Classification : *FOR Code: 290502p*

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I. Introduction

Production scheduling tools greatly outperform older manual scheduling methods. These provide the production scheduler with powerful graphical interfaces which can be used to visually optimize real-time workloads in various stages of production, and pattern recognition allows the software to automatically create scheduling opportunities which might not be apparent without this view into the data.

In manufacturing, the purpose of scheduling is to minimize the production time and costs, by telling a production facility when to make, with which staff, and on which equipment. Production scheduling aims to maximize the efficiency of the operation and reduce costs.

The Chemicals & Cosmetics Industry is quite large and important sector in Bangladesh in terms of output, export and employment. In the chemical industry, a successful manufacturer must make efficient use of limited resources to meet dynamic customer demand as customer preference change on a seasonal or monthly basis. For this prospect, an ordinary production schedule is not enough. So, we need an advanced scheduling technique.

a) Literature Review

The literature review, focusing entirely on one particular aspect of scheduling theory which is recognized & the review article which are published. in the sector of aspect. For example the literature as hybrid flow shops (Gupta, 1988).Whereas our interest is in the identical job and uniform parallel machine environment, the literature on hybrid flow shops has focused on non-identical jobs and identical parallel machines. The problem of scheduling non-identical jobs on identical parallel machines to minimize the make span is NP-hard even for a single-stage (Garey and Johnson, 1979). For an excellent review of the single stage problem the reader is referred to a paper by Cheng and Sin (1990). With more than a single-stage, the research has focused on developing heuristics (see e.g., Guinet and Solomon, 1996; Gupta Tune, 1994; Lee and Vairaktarakis, 1994; Gupta, 1988). Lawler et al. (1982) show that the I-stage problem to minimize the make span with identical jobs & uniform parallel machines may be solved in polynomial time.

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II. Problem Description

Existing Schedule: In this company the authorities follow any sequence as they like. The two plant named as Frymaco & Jansen which are evolved with the production of multiple product i.e. toothpaste, shaving cream, shaving cream cool, snow toothpaste menthol. This sometime luckily optimal but maximum time the optimal sequences are not followed due to some problem. If they normally scheduled their work the make span of their process is 64 periods. And the idle time of this process is 16 periods.

III. Algorithmic Methods

When scheduling situations become more complicated, for example when two or more processes share resources, it may be difficult to find the best schedule. A number of common scheduling problems, including variations on the example described above, fall into a class of problems that become very difficult to solve as their size (number of procedures and operations) grows. A wide variety of algorithms and approaches have been applied to batch process scheduling. Early methods, which were implemented in some MRP systems assumed infinite capacity and depended only on the batch time. Such methods did not account for any resources would produce infeasible schedules.

Mathematical programming methods involve formulating the scheduling problem as an optimization problem where some objective, e.g. total duration, must be minimized (or maximized) subject to a series of constraints which are generally stated as a set of inequalities and equalities. The objective and constraints

Global Journal of Researches in Engineering (G) Volume XIV Issue I Version I Year 2014

may involve zero-or-one (integer) variables as well as nonlinear relationships. An appropriate solver is applied for the resulting mixed-integer linear or nonlinear programming (MILP/MINLP) problem. The approach is theoretically guaranteed to find an optimal solution if one exists. The disadvantage is that the solver algorithm may take an unreasonable amount of time. Practitioners may use problem-specific simplifications in the formulation to get faster solutions without eliminating critical components of the scheduling model.

Constraint programming is a similar approach except that the problem is formulated only as a set of constraints and the goal is to arrive at a feasible solution rapidly. Multiple solutions are possible with this method.

a) Model Formulation of a Flow Shop Problem

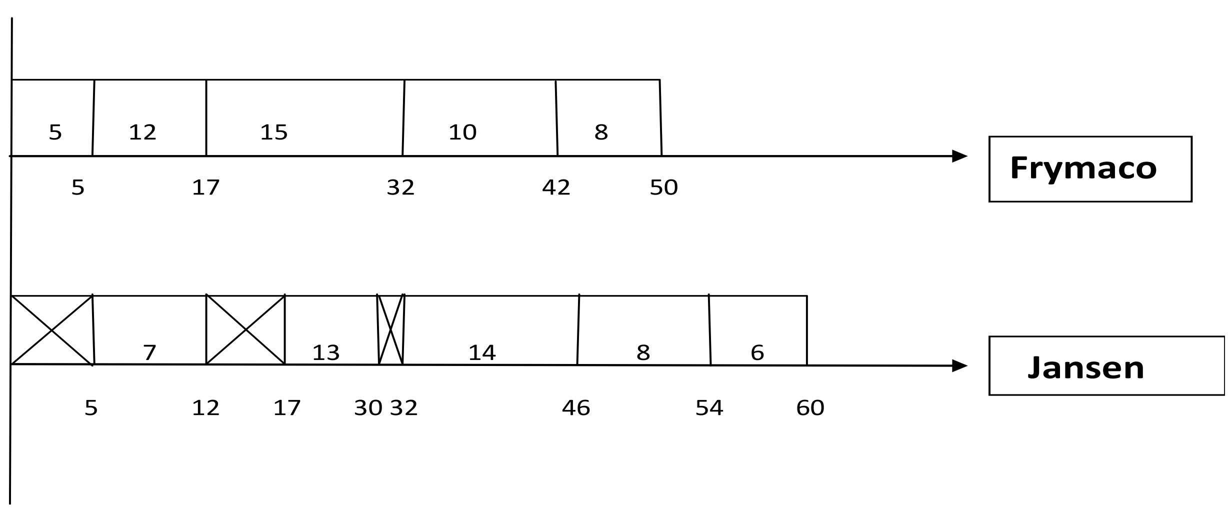
Job	Frymaco (units time)	Jansen (units time)
Toothpaste	8	6
Shaving cream	12	13
Shaving cream cool	15	14
Snow	5	7
Toothpaste menthol	10	8

b) Solution Approach

The sequence of the Algorithm is summarizedin the table which is given below:

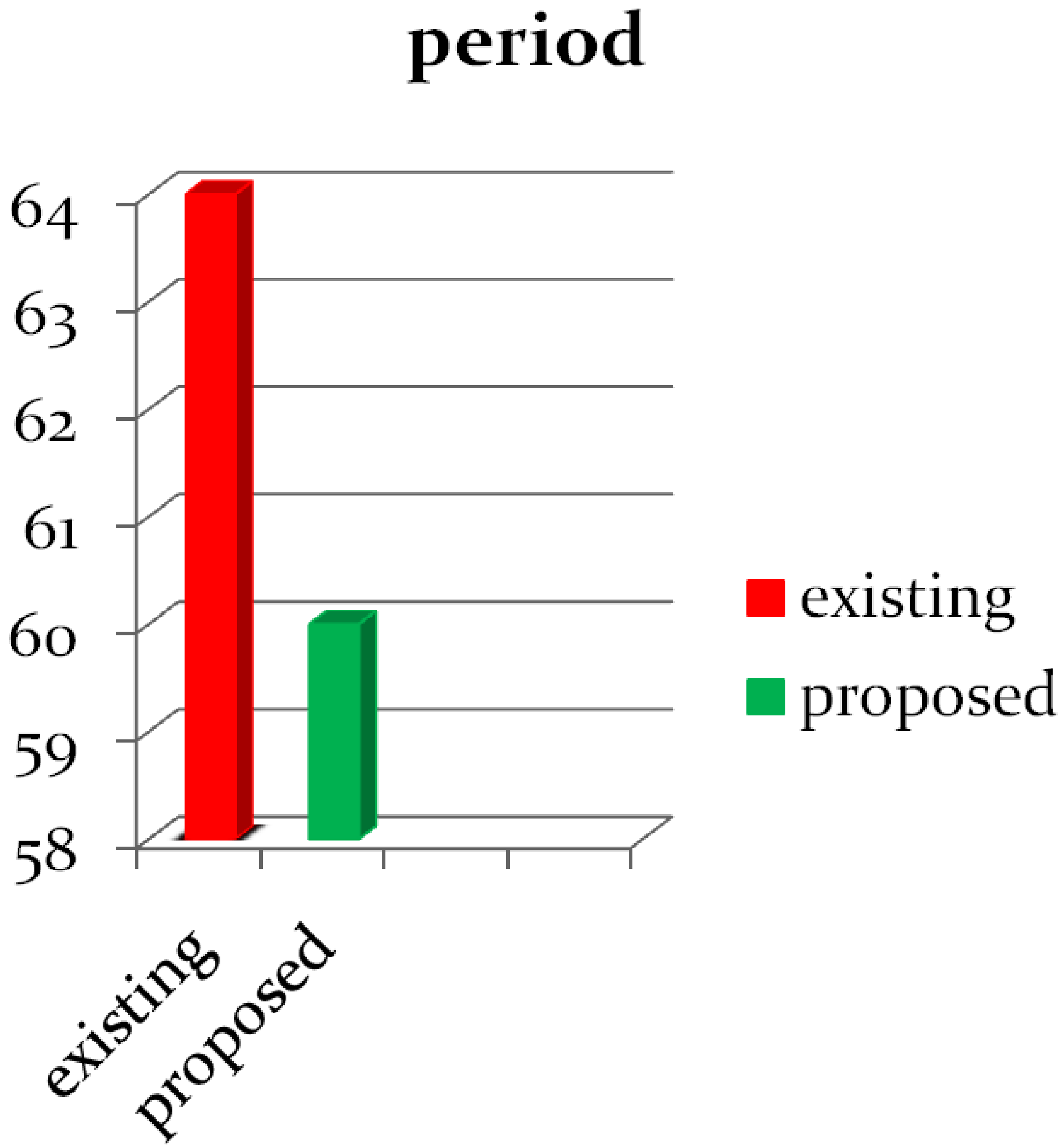
Stage	Unscheduled job	Minimum time	Assignment	Sequence
1	1,2,3,4,5	t_{41}	4=[1]	4,*,*,*,*
2	1,2,3,5	t_{12}	1=[5]	4,*,*,*,1
3	2,3,5	t_{52}	5=[4]	4,*,*,5,1
4	2,3	t_{21}	2=[2]	4,2,*,5,1
5	3	t_{32}	3=[3]	4,2,3,5,1

c) A Gantt Chart for proposed Schedule



IV. Numeric Result

So the optimal sequence of this model 4-2-3-5-1 & the make span 60 period. The idle time 12units.



a) *Limitation*

- Ready time is zero.
- Machines should keep always active in working hours and never breakdown.
- Lay out of floor is ignored.
- Data are collected from only one week.

V. Conclusion

Since the chemical industry is mostly based on both human performance and machine performance, there is a chance to develop the technical aspect. For this reason time is the major constraint to utilize the workforce with limited resource. This problem may be solved by using a better schedule. In this sense the flow shop model is noble idea and implementation of this model solving by Jonson's Algorithm is satisfactory.

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