CHAPTER 1

INTRODUCTION

1.1. Background

Production scheduling plays an important role in production system. It affects the production capacity which later defines the firm's competitive boundaries. The inappropriate production scheduling will make the capacity is inadequate or excessive. If capacity is inadequate, a company may lose customers through slow service or by allowing competitors to enter the market. And if capacity is excessive, a company may have to reduce its prices to stimulate demands, underutilize its work force, carry excess inventory, or seek additional, less profitable products to stay in business (Chase, 1995).

Scheduling is the process of organizing, choosing, and timing resource usage to carry out all the activities necessary to produce the desired outputs at the desired times, while satisfying a large number of time and relationship constraints among the activities and the resources (Morton and Pentico in Sipper and Bulfin, 1997).

One of scheduling objection is to minimize production and labor cost (Nahmias, 2005). To achieve this goal, production schedule must be arranged as effective and efficient as possible to reduce the total production time because bigger total production time will make the higher production and labor cost.

Total production time in this research refers to the makespan. Makespan is the flow time of the job that

is completed last. It is also the time required to complete all *n* jobs (Nahmias, 2005). Minimizing makespan is a common objective in scheduling problems, which is become the research objective in this research.

The Production System Laboratory of Universitas Atma Jaya Yogyakarta has a long term research project about makespan minimization in multilevel product that is affected by the complexity of product structure (*Bill of Material or BOM*), process routing, and setup - run time ratio.

Multilevel product is product which consists of several assembled components, while complexity of product structure contains number of product level and number of part in one level. Routing file contains the number of operations and machines. Setup - run time ratio is ratio defined by the average of setup time in one product structure divided by average of total run time times for one lot.

There are some variables used in this research. They are lot size, setup time, and run time. Lot size defines a certain number of product that should be processed by one time of setup. This research will evaluate some variation of lot size to find a lot size which is resulting in minimum makespan. Lot size that results this minimum makespan is called optimum lot size.

Setup time is time needed for preparing machine to process product once in a certain number of unit. Run time is time needed to process part in certain operation.

This research uses 3 level of product structure with maximum number of parts are 4 in each level, and 30 as the total number of item produced while the lot sizes evaluated are 5, 6, 10, 15, and 30. The routing file consists of 3 kinds of machines and 1 unit for each, and up to 5 operations.

1.2. Problem Statement

Based on the background, the problem of this research is how lot size and product structure complexity gives effect to the minimization of makespan in the multilevel product scheduling.

1.3. Research Objectives

a. To define the effect of lot size due to minimization of makespan.
b. To define the effect of product structure complexity due to optimum lot size.

1.4. Scope of Research

The limitations in this research:

a. Using product structure that is generated to fulfill requisite 3 level product structure with maximum parts are 4 in each level.
b. Using 30 as the total number of item produced while the lot sizes evaluated are 5, 6, 10, 15, and 30.
c. The routing file consists of 3 kinds of machines and 1 unit for each.
d. One machine represents one process.
e. Using 3 machines and up to 5 processes or operation for each parts.

f. There is no variation in the sequence of processes and machine usage in routing file.
g. Setup time is generated by random number that is varied from 5 to 10 minute/lot.
h. Run time is generated by random number that is varied from 1 to 5 minute/unit.
i. Routing files is generated in 5 replications.
j. There is no differences between routing file except in setup and run time.

1.5. Research Methodology

1.5.1. Preparation Steps

Preparation steps contains activity to collect supporting information process for this research, that is the effect of lot size due to makespan and product structure complexity due to optimum lot size.

1.5.2. Generating Data Process

In this step, writer generates data that is needed in this research. The data includes product structure, routing file, and lot size. This research uses 3 level of product structure with maximum parts are 4 in each level where the possible product structure forms are generated to fulfill that definition. It results 11 combinations of product structure.

Five routing files are generated that have the same sequence of operation and machine used, but different setup and run time for each routing file. Routing file has maximum 5 operations and 3 machines where one machine represents one process and placed in one work center. Setup time is generated by using

random number in Ms excel, which varied from 5 to 10. Using the same analogy, run time is varied from 1 to 5. Thirty is used as the total number of item produced, while the lot sizes evaluated are 5, 6, 10, 15, and 30.

1.5.3. Data Processing Step

Data is proceed to result makespan for each product structure and routing file. Gantt chart is used in this step. This Gantt chart is proceed manually by using Ms. Excel.

1.5.4. Data Analyzing Step

The data processing step will result list of minimum makespan of each product structure and routing file, which later is analyzed by using Anova Single Factor.

1.5.5. Report Arrangement

Making the final report after gaining all needed data and result in this research

1.5.6. Research Flowchart

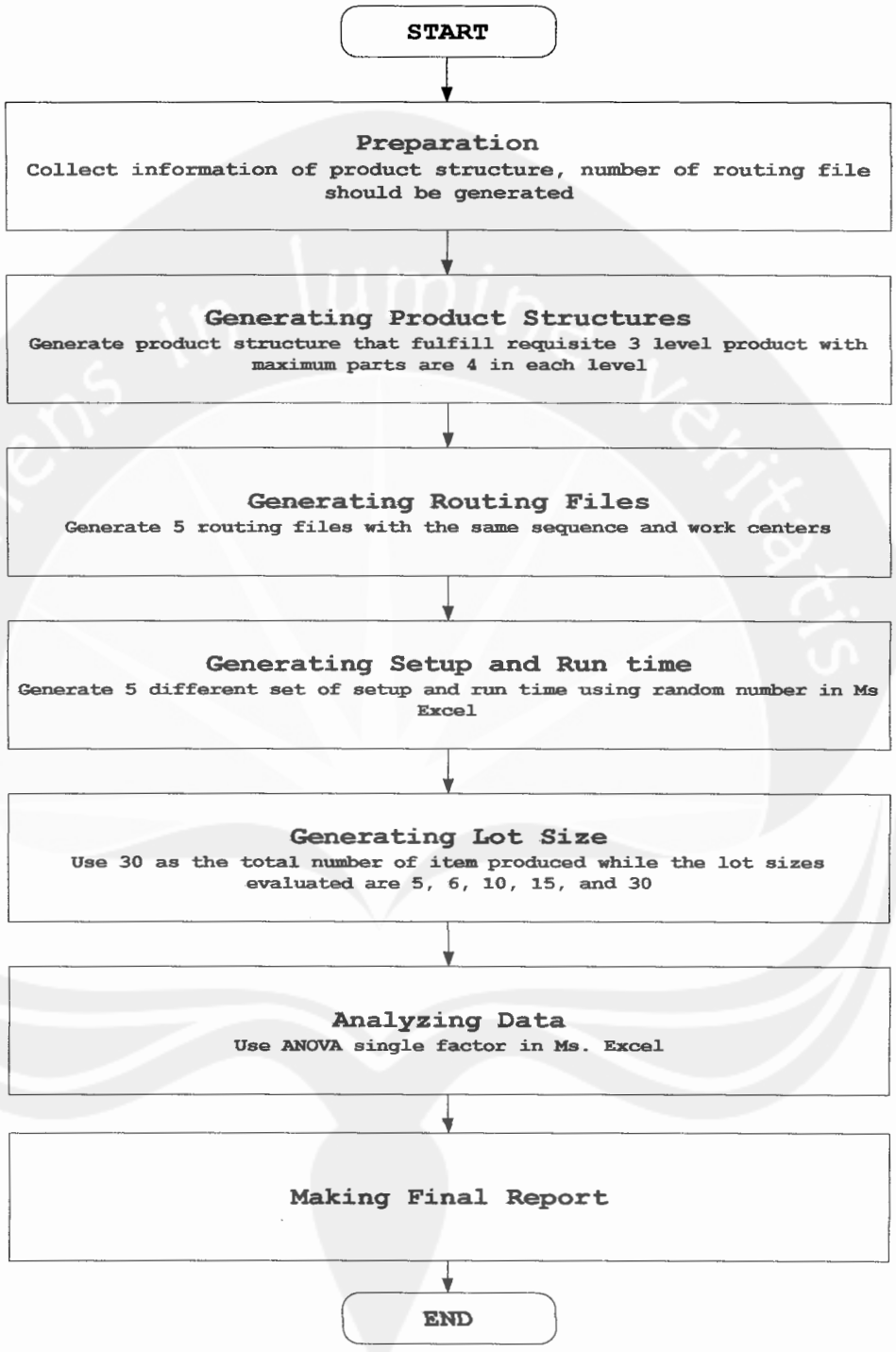

Figure 1.1 Research Flowchart

1.6. Report Outline

This research contains 5 chapters. The first chapter provides the description of this research background, problem statements, research objectives, scope of research, research methodology and report outline.

The next is chapter 2, which contains the literature review of earlier researches as supporting information for this current research. The comparison between earlier and current research is also described in this chapter.

Entering chapter 3, where the basic theory of scheduling will be discussed one by one which is useful as the reference for this research.

The data analysis and discussion will be found in Chapter 4. And finally the result, conclusion, or suggestions are in the last chapter of this thesis, which is chapter 5