Crude scheduling in refinery operations

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ABSTRACT

Scheduling is an important aspect in many industries such as the pharmaceutical, food processing, manufacturing and refining industries. Application of efficient scheduling methods will significantly improve productivity and cost effectiveness of non-continuous processes, while poor scheduling may result in great loss.

A local refining company feels that it is necessary to build a new scheduling program. The main objective of the scheduling program is to ensure that within the planning horizon, operations are within inventory limitations. Furthermore, there are other operational objectives that can be achieved with the aid of this program. Building the program is what this project is all about.

Microsoft Excel with Visual Basic Applications (VBA) is the chosen software as it is capable of handling the simulation dynamically and data storage. Visual Basic Applications provide the tools for a user-friendly GUI.
The scheduling program, which is still under continuing development, will be very useful for the refinery operations. As more and more features are implemented towards the objectives, the significance of the program to the refinery operations will be even stronger.

INTRODUCTION

In a refinery, scheduling of crude oil includes the certainty of continuous supply of the right type of crude oil to feed the main distillation units of a refinery according to the monthly plan. The constraints involves in this scheduling problem are those related to ship arrivals at the berths, availability of the mooring point and storage tanks and availability of the connecting pipelines in the field. Typically, the monthly refinery plan is determined according to forecasted demands of the various products as well as the approximate crude types availability in the storage tanks.

A local refining company feels that it needs to improve its current scheduling program. The current scheduling program is written in an archaic programming language, such that it is hard to make modification or add some extra features. Hence it is necessary to build a new scheduling program which is able to do everything the current program does, more flexible, and has a lot of rooms for new, extra features.

This project is part of a bigger, longer-term project which will incorporate an optimizer to the scheduler. This optimizer will help the user find the optimum schedule, in order to maximize profit, minimize cost, maximize throughput, or other objectives. This project is carried out by a group of NUS students, supervised by a staff from the refining company, which acts as a client, giving
directions as to how the scheduling program should be developed to best suit the needs of the company.

**PROBLEM STATEMENT AND OBJECTIVES**

Developing a scheduling program is a big and complex problem, since it involves a lot of computations, input/output, graphical user interface (GUI), graphs, plots and interfacing with other programs. The program should be able to model and simulate the activities involved in the refinery operations.

There will be a need for a set of database to record the various data involved, when simulating the activities. Microsoft Excel with Visual Basic Applications (VBA) is the chosen software as it is capable of handling the simulation dynamically and data storage. Visual Basic Applications provide the tools for a user-friendly GUI.

The main objective of the scheduling program is to ensure that within the planning horizon, operations are within inventory limitations. In other words, it is to ensure that all ships find ullage and all CDUs find volume, as they are both competing for a common resource, i.e. tanks. The scheduling program also helps to ensure that operations are within the operational constraints. Other objectives are to minimize vessel demurrage, to stretch the available feedstock to avoid unit shutdowns, to keep the RCC running at its designated throughput, to minimize crude changes (guideline being less than 18 per month), to meet the crude throughput target, to produce early warning of quality problems, and to generate reliable information for daily process plan and production forecasting.
DISCUSSION ON PROGRAM

Significance of Program to Refinery Operations

The scheduling program will be very useful for the refinery operations. With the current ability of the program, some of the objectives have already been met. The program will help in ensuring that within the planning horizon, operations are within inventory limitations. The program to a certain extent is flexible in the sense that it allows incorporation of new resources in the future (e.g. pumps, tanks, CDUs, etc). It also allows modification of certain operational constraints.

The program is user-friendly, although the GUI is still under development. Furthermore, Microsoft Excel has the capability of interacting with H/CAMS and RIS, the two packages of software which are currently used in the refinery.

Limitations of Program

The program is not complete as yet since many features or functions have not been coded for yet. This is mainly due to the many objectives to be reached, the complexity of the problems, and the lack of manpower and working time. As the program grows bigger in size, more and more data being collected, computation time might become an issue.

Some of the current program limitations, the features yet to be coded, are going to be taken care of in the future since this project is continuing even after the submission of this report.
CONCLUSION

The scheduling program has proven to be a significantly useful tool in refinery operations. It provides great assistance in achieving certain objectives of scheduling. Although currently the program has its limitations, it is believed that it is on the right track. Hence, more efforts will be put into the further development of this scheduling program.

REFERENCES

