Self-Service Laundry Scheduling

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Executive Summary

A self-service laundry as found at apartments and laundromats is an example of a situation where fair or efficient use of shared resources is desired. A user may want to maximize performance of their tasks to complete their work with minimum time or expense. However, performance is hindered by limited resources and use of resources by other users. Examples include machines being used, abandoned laundry, and machine capacity.

Management might address these issues with rules such as limits on concurrent use by a single user and removing abandoned laundry after a time limit. However, these rules have parameters that may require tuning to optimise and may not solve the problem.

An analysis of laundry scheduling will help reveal the impact of rules and their parameters. It may also uncover additional rule options and their effects. This enables management to set effective rules. Individual users may benefit from an analysis by informing them of effective strategies that may not be dependent on action from management.

This project will attempt to answer the following questions:

1. How do rules affect overall and individual performance? (Scheduling)
2. When should a user start/stop waiting? (Stopping)
    a. What is a safe latest time to start waiting?
    b. What is the expected wait time for a given user?
3. How do proposed systems function when individuals do not follow rules? (Game Theory)

Project Design and Methods

Data will primarily be quantitative and collected from simulated experiments. The possible discrete task segment times and total availability window will be recorded. Additionally, a small observed sample of usage times will be collected from a single location on campus. Distributions will be created using collected preliminary data.

This project will use classes for common functionality between algorithms. Output will be reported using Matplotlib over time steps. The first question will use a scheduling algorithm with variable factors. The second will look for optimal stopping points for wait times. The third will partially return to the first and compare different user strategies.

This situation has aspects of a scheduling problem using mostly FCFS scheduling. The task of completing laundry additionally has segments such as using the dryer. This allows the use of pipelining to improve performance. Pipelining also provides a rough upper bound on performance for concurrent tasks.

Actual implementations and findings will rely on situational specific information. On-campus housing uses similar machines allowing possible segment times to be fixed. However, the number of machines and the parameters of populations using them may vary between locations or semesters.

Time to implement this project is limited. The research schedule provides intended outcomes and their timing.

Implications and Contributions to Knowledge

This project may guide the actions of management and individuals to fairly allocate resources and use resources effectively. Findings may also be used to compare results and provide support for actions taken to achieve desired outcomes. This project may be easily adapted to similar shared scheduling problems.

Research Schedule

Research phase	Objectives	Deadline
Preliminary Data Collection	Record possible conditions and observe a sample of actual conditions	April 16
Simulation Framework	Create objects to be used in algorithms and a method to report results	April 26
Algorithm 1: Scheduling	Find factors to improve performance	April 26
Algorithm 2: Stopping	Find optimal wait times for users	April 27
Algorithm 3: Game Theory	Find strategies that are disruptive or fair	April 27
Submit Final Report	Report on findings and how to use project	April 28