Individual Design Journal 5 **Basil R. Yap**
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Project 61: Steelcase Due Date: 2018/05/27

Problem Statement

For the Week 1 of Term 8, the focus of the group is centred around the implementation of the designs we proposed in Term 7. In order to do so in a timely manner, the team and I are moving forward by de- constructing our deliverables backwards from submission to implementation, from Showcase to the current week.

Therefore, the problems tackled since the start of the term are as follows:

a) De-constructing deliverables and making a work plan for Term 8 *

   Creating a work plan would be vital to the progression of the project for Term 8. With each sub-team working relatively independently, it is important that each sub-team is aware of the deliverables/progress of all other sub-teams. It also allows us to plan for contingencies, if required.

b) Implementing *Container Loading Optimization* algorithms suggested in Term 7

   As we enter into the Implementation/Prototyping phase of the project, we are pressed for time to implement the various algorithms suggested. Implementation is vital to the benchmarking process, without which we cannot determine the compare effectiveness between algorithms.

* The work plan I will be referring to for the remainder of the Journal will be with respect to the *Container Loading Optimization*, as that is the component of the project that I am working on for the remainder of this project.

De-constructing deliverables and making a work plan

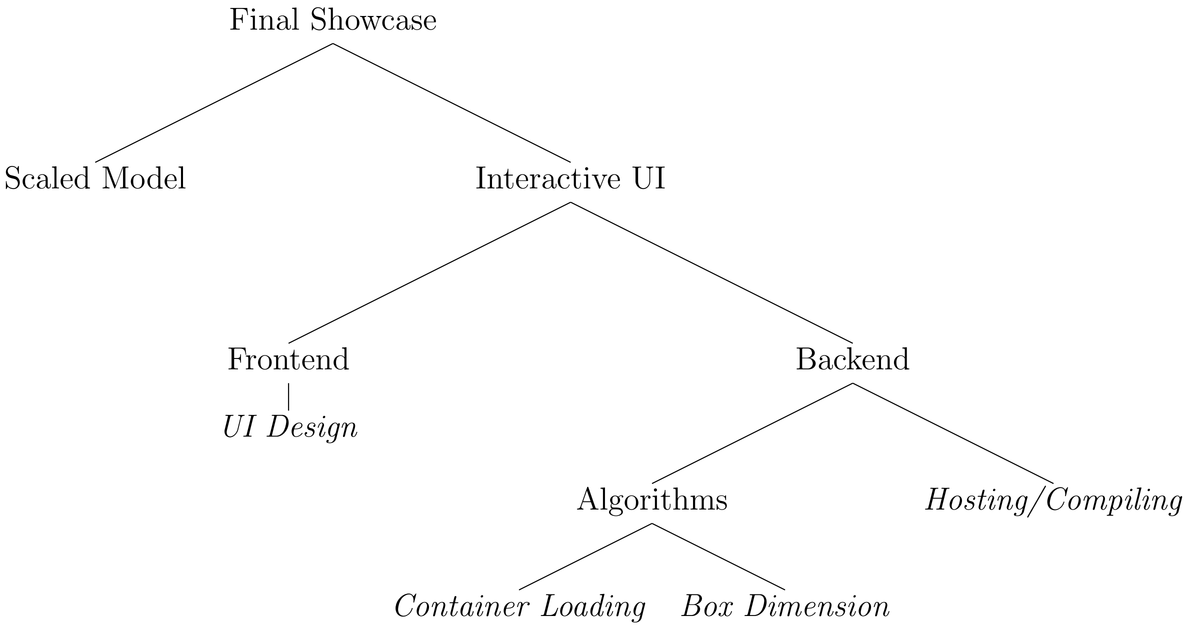
After some discussions with the team, we concluded with the following list of deliverables for the Final Showcase:

a) Scaled down model of mechanisms in packaging design

b) Interactive interface for *Container Loading* and *Box Dimension* algorithms.

c) Posters and other visual aide

Working backwards, we can breakdown the deliverables into the following components:



Breaking down the deliverables, my proposed work plan for Term 8 is as follows:

Week 1: Work assignment and planning

Week 2: Implementation of proposed algorithms in Python

Week 3: Benchmark algorithms for packing efficiency and runtime

Week 4: Attempt basic UI design to visualise solution

Week 5: Integration between UI and algorithm &
Research options for Hosting/Compiling application

Week 6: Review 3

Week 7: *Buffer time*, clear backlog (if any)

Week 8: Address implementation concerns for Steelcase management team

Week 9: Further UI designs with emphasis on UX

Week 10: Debug and Re-factor application

Week 11: Final preparations for Final Showcase

Week 12: Final Showcase

Week 13: Final Report

Implementing *Container Loading Optimization* algorithms

At the end of Term 7, I concluded that the algorithms can be classified into three categories:

1) **Class 0**: Simple Heuristics
   - Easy to understand
   - No computation required
2) **Class 1**: Simple Algorithms
   - Good Average Optimality
   - Minimal computation required
3) **Class 2**: Complex Algorithms / Mathematical Program
   - (Close to or) Exact Optimal Solution
   - Heavy computation required
   - Difficult to debug

From the 3 classes, we concluded that **Class 1** was the best option when considering Steelcase Malaysia's current technology infrastructure and operation flow.

Currently in the progress of implementation are:

1. Extreme Point-Based Heuristics[1]
2. Branch and Bound with pricing oracle[2]
3. Tabu Search with diversification phase[3]

References

[1] Crainic,T. G, & Perboli, G., & Tadei, R. (2007) Extreme Point-Based Heuristics for Three-Dimensional Bin Packing. *INFORMS Journal on Computing*, *20*(3). 368 - 384.

[2] Sadykov, R., & Vanderbeck, F. (2010) Bin Packing with Conflicts: A Generic Branch-and-Price Algorithm. *INFORMS Journal on Computing*, *25*(2). 244 - 255.

[3] Muritiba, A. F., & Iori, M., & Malaguti, E., & Toth, P. (2010) Algorithms for the Bin Packing Problem with Conflicts. *INFORMS Journal on Computing*, *25*(2). 244 - 255.