Chapter 3

Methodology

The model for the BAP consists of various sub components which are dependent upon each other. The following is a list of such components that embody the BAP.

* Demand
* Supply
* Expiry
* Importation
* Blood compatibility
* Blood unit daily remainder

Due to the different aspects which make up the BAP, it is necessary to break up each component in detail in the following chapter. The following chapter will also describe the blood issuing policy and overall structure of the blood bank.

Figure A

Step 9: Identify the best performing MH technique that was able to minimize the objective function

Step 8: Establish performance measures to evaluate results

Step 7: Record results achieved, and document the findings.

Step 6: Subject each MH technique to the datasets

Step 5: Randomly generate data.

Step 4: Create values which will be used as bounds for the datasets

Step 2: Generate algorithms and equations.

Step 3: Implement the MH techniques in conjunction with equations and algorithms from step 2

Step 1: Identify 5 different metaheuristic techniques to be modelled and an issuing policy for the BAP.

Figure A: Represents the flow of activities carried out for the methodology for the BAP

Step 1: Identify 5 different MH techniques which differ from previous research the tackle the BAP.

Step 2: As mentioned previously, the BAP is comprised of various mathematical components which will need adequate equations and/or algorithms to solve each component.

Step 3: Use the algorithms and equations from step 2 in conjunction with the MH techniques to work the problem.

Step 4: Due to confidentiality issues, datasets will be randomly generated values between certain percentage bounds.

Step 5: Using the percentage bounds, values can then be generated in accordance to each dataset.

Step 6: The values generated can then be implemented in each MH technique in order to find an optimal solution.

Step 7: Record the results achieved by each MH technique for all datasets and document the results in a meaningful way such as line graphs etc.

Step 8: The performance measures will identify which of the MH techniques achieved the best results.

Step 9: The best MH technique(s) in step 8 will be used for any real world applications.

3.1 Allocating Blood Unit Supply

The FIFO method proves most prudent when allocating WB units to patients. This method allows for the oldest units of blood to be used first in order to minimize wastage. All demands for a day must be met, therefore any blood types that have an insufficient supply (even after pulling additional units from compatible blood groups) will result in importing additional blood units from external sources. In this study, frozen WB units will be ignored, and only fresh WB units with a lifespan of 30 days will be considered. Figure B illustrates the process for allocating WB units to patients in need. As mentioned in chapter 1 the BAP model that is implemented tries to also accommodate data from a social aspect of the South African population. This social aspect was established by identifying trends in the demand and request of blood products on a yearly basis.

Figure B

Start

Are there traces of expired WB units?

Yes

Is day less than or equal to 365?

No

End

Yes

Yes

Update supply for the day

Calculate remainder for the day.

Fulfil demand for the day

Import additional WB units from external sources to meet the demand.

Yes

Is Demand greater than updated supply?

Yes

Pull additional units from the remainder of compatible blood types.

Is Demand greater than supply?

Remove expired units from blood bank, and update current useable supply

No