ITECH7410
Software Engineering Methodologies

Assignment 2 **Group Assignment** - (Groups of 2- 3)

Specification of a System - Wheat Truck Control System (WTC)

Overview

As a Software Engineering consultant, your task is to develop a formal specification in Z for the proposed system described below. You will present your work to show that your system does work and answer questions about the system specification your group has developed.

Timelines and Expectations

Percentage Value of Task: 20%
Due: Friday, September 29, 2017 - 17:00 (Week 11)

Minimum time expectation: 10 hours

Learning Outcomes Assessed

S1. Critically analyse and use complex decision making to research and determine the appropriate Software Engineering tools and methodologies to utilize in a given situation.

S2. Apply professional communication skills to support and manage the engineering of a large software system.

S3. Review, critically analyse and develop artefacts to define processes for quality assurance, risk management and communication in large software development projects.

S4. Implement quality assurance activities in order to verify user requirements and validate design decisions.

A1. Analysis of a large system development problem to decide upon the best methodological approach.

A2. Development of appropriate artefacts to support and manage the software engineering process such as change control and configuration management.

Assessment Details

A new computerized system is to be developed for the storage and handling of accounts for wheat farmers and truck deliveries to Mahsroh Wheat Board silos. Detailed below are the major objects to be considered in the system: silos, ships, trucks and farmers. This system could be quite complicated. However, to simplify the system for this assignment we will be content to include the following in our proposed system:

Silos

The Board currently has ten (10) wheat silos around the country but the system must be written to seamlessly handle at least twice that number. Each silo has a unique name and storage capacity (in tonnes) that must be stored in the proposed system. In addition the system must maintain the current amount of wheat stored in the silo. Obviously when the silo is full no further deliveries of wheat can be made to that silo before some is offloaded onto a ship for export overseas. Similarly a silo cannot off-load more wheat onto a ship than is currently stored. We will assume that when off-loading to a ship, no trucks can unload due to operational and safety considerations. Only one ship can be handled at a time at each silo.

We will assume that only one truck can unload into a particular silo at any one time. Therefore during busy times each silo also maintains a queue of trucks waiting to unload. Trucks should only be entered into the waiting queue when there is sufficient room for the wheat that the truck holds, i.e. you need to know that the current storage plus all the loads currently in the queue will not exceed the silos capacity.

Ships

The system will keep a record of all ships that have been registered to transport wheat overseas for the Wheat Board. The ships name, nationality and capacity (in tonnes) will be stored. The ship's captain can specify the amount of wheat to be off-loaded into the ship as long as it is less than the ships capacity and also the silos current amount in storage. The system will keep a record of the amount of wheat off-loaded to the ship and adjust the current storage appropriately.

Trucks

As each loaded truck arrives at the silo, it is weighed to ascertain the amount of wheat in the truck. The system maintains a list of registered trucks and their empty weight (in tonnes). Therefore, a single weighing is sufficient to determine the wheat load. If there is sufficient room in the silo then the wheat is off-loaded into the silo and a record is kept of the amount off-loaded against both the truck registration number and the farmer providing the wheat.

Date and Time

Normally we would maintain the date and time of each operation (truck delivery or ship off-loading) however to simplify this assignment we will ignore those aspects. Instead, we will keep a sequential count of each operation for each silo. Therefore, we will have a history of the order of truck unloading and ship off-loading operations that take place for each silo.

The system would be able to say for example, that silo HORSHAM_1, operation number 999 involved 25 tonne of wheat delivered by the truck registered TONKA owned by Jack Black from farmer Bob Smith. Then operation 1000 was an off-loading operation of 125,000 tonnes to the ship "Southern Aurora".

There is also a need to keep track of the operation order between silos, therefore we will keep a global sequential count of the operations at silos as well. Refer to the table below as an example:

Global No	Silo	Count	Operation	Vehicle Name	Tonnes	Farmer
...						
12336	HORSHAM_1	999	Load	TONKA	25	Smith, Bob
12337	MELBOURNE	555	Load	DUPLO	20	Jones, Mark
12338	HORSHAM_1	1000	Off-Load	Southern Aurora	125,000	
12339	MELBOURNE	556	Load	LEGGO	50	Simons, Jill
12340	HORSHAM_1	1001	Load	TONKA	25	Jones, Mark
...						

You will need to decide how to demonstrate that your system specification works and satisfies the client requirements. (You might wish to discuss your approach with your tutor.)

General Comments

The submission must be presented in a professional, clear and concise manner. If you need further system information please use your initiative and make reasonable and logical assumptions. Questions of a general nature (for example to clarify some part of the assignment requirements) can also be sent to the discussion forums, note these should not in any way give solutions or parts thereof. Similarly you are encouraged to ask questions about the Z specification language, it is not simple and no students will have encountered it before.

Requirements:

Z Schema Operations

You are to create a Z schema that adequately describes the WTC system. It should include at least one state space and the following operations:

- An initialization operation called **Init**.
- An operation **Enter_new_silo** that an operator uses to enter the details of a new silo into the system. Assume the new silo is currently empty.
- An operation **Accept_delivery** that an operator uses to signal the system to begin off-loading x tonne of wheat from a truck. Note that the system must do a check to see if that storage capacity is available in the silo, if not then an error message must be output and no truck unloading done. Additional information needed by this routine is the truck registration and the farmer's name. If successful this operation stores all necessary details into the system for that delivery. If a truck is already unloading then this new truck will be placed in a queue waiting for its turn to unload.
- An operation **Leave_queue**. This operation is run by the system operator each time there is a queue for a silo and the driver of a specified truck decides that the anticipated waiting time is too long and leaves the queue. The operation outputs to the operator the list of trucks in the queue after the specified truck is removed or if none in the queue a reasonable error message.
- An operation **Silo_account** that outputs the total amount of wheat in tonnes delivered to a particular silo by ALL farmers in a specified time period (note that means between two global operations numbers in our simplified system). In other words between global operations 10000 and 10500 for example.
- An operation **Ships_total_account** that outputs the total amount of wheat that a particular ship has taken from ALL silos in the total history of the system.
- An operation **Farmers_account** that outputs the total amount of wheat delivered to ALL silos in between two specified global operation numbers (e.g. 10000 and 10500).

You should provide robust versions of each operation that are capable of handling any possible error conditions. For example, if the ship or truck is not correctly registered in the system an appropriate error message must be given.

The submissions will be considered for presentation, conciseness and correctness (both logically and notationally). Versions of the operations that are developed using the Z Schema Calculus will be more highly considered than monolithic versions that account for all conditions within a single schema.

You should also add a narrative in the report to explain any schemas or logic that you have used. Schemas should be annotated. Authorship should be made clear.

You will be asked to explain and answer questions about your work in a presentation - which will be scheduled at a suitable time – in either labs or lecture.

Submission

Your assignment should be completed according to the Guides to your assessments

https://federation.edu.au/__data/assets/pdf_file/0018/190044/General-Guide-to-Writing-and-Study-Skills.pdf

Using the link provided in Moodle, please upload the following in one zip file as directed by your lecturer.

Name your zip file in the following manner:

<GivenName_FAMILY-NAME>_<ID>.zip

e.g. Aravind_ADIGA_30301234.zip

The assignment must be submitted electronically through the Moodle assignment system in Microsoft Word document format, rtf format or as a pdf document. If you are unable to provide one of these formats please contact your lecturer/tutor by email prior to submission to ensure that they will be able to handle the alternative format.

To alleviate any problems with fonts and symbols for the Z specification all students **must** use the Zed true type font that is available on Moodle. Note this zip file has both true type and Adobe Type Manager files for both Windows and Macintosh machines. Please make sure you use the true type font. The archive contains a Readme.txt file that explains how to install the font.

Feedback

Assessment marks will be made available in fdlMarks, feedback to individual students will be provided via Moodle or as direct feedback during your tutorial class

Plagiarism:

Plagiarism is the presentation of the expressed thought or work of another person as though it is one's own without properly acknowledging that person. You must not allow other students to copy your work and must take care to safeguard against this happening. More information about the plagiarism policy and procedure for the university can be found at:

http://federation.edu.au/students/learning-and-study/online-help-with/plagiarism

Your support material must be compiled from reliable sources such as the academic resources in Federation University library which might include, but not limited to: the main library collection, library databases and the BONUS+ collection as well as any reputable online resources (you should confirm this with your tutor).

Federation University General Guide to Referencing:

The University has published a style guide to help students correctly reference and cite information they use in assignments. A copy of the University's citation guides can be found on the university's web site. It is imperative that students cite all sources of information. The General Guide to Referencing can be purchased from the University bookshop or accessed online at:

http://federation.edu.au/library/resources/referencing

Suggested References:

Weeks 4 and 5 study materials and Section 4 of study Guide 3

The Z Notation: A Reference Manual http://www.rose-hulman.edu/class/cs/cs415/zrm.pdf

Using Z http://www.comlab.ox.ac.uk/igdp/usingz

Sections 21.5, 21.6 and 21.7 from Pressman 7th Ed.

Solutions for Problem 2 of Week 6 tutorial problems

Introduction to Z Notation - http://www.youtube.com/watch?v=qfEe9luJmVE

Marking Criteria

Group Name: _____

Student ID:_____**Student name:**_____

other members in the group

Student ID:_____**Student name:**_____

Student ID:_____**Student name:**_____

Task		Mark
Z Schema Operations **Schema = 4 marks** Concise & correct Notation & logic correct **Schema Annotations = 4 marks** Relevant, concise & clear	**Init**	**8**
	Enter_new_silo_account	**8**
	Accept_delivery	**8**
	Leave_queue	**8**
	Silo_account	**8**
	Ships_total_account	**8**
	Farmers_account	**8**
1. Evidence that system works correctly – included in report		**14**
2. Report – adheres to the FedUni guidelines for the presentation of academic work		**10**
3. Presentation – discuss your contribution – development & testing, answer questions about the system		**20**
	Total	**100**
	Final	**/20**

Comments