**SKEE2263**
**Term Project**
**Student Guide - SPACE**

Beginning this semester, 30% of your final marks are derived from the term project. At the end of term, you must implement a complete digital system an Altera FPGA board. You are to build a **Teh Tarik Vending Machine**. To ensure you successfully complete the project, the term project has 6 different tasks, so that you build the complete system incrementally. The following Gantt Chart outlines the tasks.

| Task | | Meeting | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | Quartus familiarization | | | | | | | |
| 2 | Altera built-in module familiarization | | | | | | | |
| 3 | Construction of combinational modules | | | | | | | |
| 4 | Construction of sequential modules | | | | | | | |
| 5 | Datapath unit integration | | | | | | | |
| 6 | Control unit implementation | | | | | | | |
| 7 | Presentation/Demo | | | | | | | |

The end of each task is a milestone, and you are to deliver the following:

| Milestone | Date | Submit |
|---|---|---|
| 1 | Meeting 2 | 4-bit adder |
| 2 | Meeting 3 | 4-bit to 7-segment decoder |
| 3 | Meeting 4 | 4-bit 4:1 multiplexer, 4-bit comparator, switch input |
| 4 | Meeting 5 | 4-bit register & 7-seg display output |
| 5 | Meeting 6 | Datapath unit for teh tarik vending machine |
| 6 | Meeting 7 | Completed system |

Completion of a milestone is worth 5% of the overall grade.

Task 1 is common to everybody and must be completely individually. It involves simulation only. Tasks 2-6 are done in groups of 3. These tasks are done on the FPGA board.

**Brief description of Teh Tarik Vending Machine**

The machine can receive 10, 20 and 50 sen. When RM1 is received, it dispenses a cup of teh tarik.

Three inputs represent 10, 20 and 50 sen. A pulse at one of the inputs means a coin is inserted. Hardware interlock ensures only one signal is active at any time. When a pulse is detected, it converted into a pulse exactly one clock cycle. Each pulse updates a 4-bit register which stores the amount deposited so far. Every 10 sen increases the accumulator value by 1.

A seven segment display shows the current accumulated amount. A comparator is permanently connected to the accumulator. When the comparator detects that the amount of money is at least RM1, a signal is given to the control unit to dispense the teh tarik and reset the accumulator. No change is given if more than RM1 is given.

Bonus: store and accumulate the sen amount in BCD.