



King Mongkut's University of Technology Thonburi

Seat No. \_\_\_\_\_

Computer Engineering Department

Midterm Exam Semester 2/2557

**Course:** CPE 333 Software Engineering

**Program:** Computer Engineering, 3<sup>rd</sup> Yr.

**Date:** Wed 25<sup>th</sup> February 2015

**Time:** 9:00 – 12:00

**Name:** \_\_\_\_\_

**ID:** \_\_\_\_\_

---

**Instructions:**

1. Permitted: Only one A4 (or smaller-sized) sheet of paper. No other notes or books are permitted.
  2. Permitted: One simple calculator with no programming, or note-taking, or communication features as per university regulations on calculators.
  3. Permitted: One paper based dictionary.
  4. Students using more than 1 sheet of the above paper will be considered “cheating” and face appropriate disciplinary action in accordance with university regulations.
  5. There are 4 parts in 11 pages including this instruction sheet. The total score is 100 points.
  6. Please write all your answers in this examination document.
- 

This examination is designed by

Assoc. Prof. Suthep Madarasmi, Ph.D.

Assoc. Prof. Tiranee Achalakul, Ph.D.

Asst. Prof. Marong Phadoongsidhi, Ph.D.

Telephone: 02-470-9080

**Part I: Compute FP Size Metric**

Krungthep University (KU) currently receives grades for each course per semester from the course instructor on a printed sheet of paper. The university wishes to create a simple web application called *Online Grades* that will allow instructors to electronically submit each course's grade per semester. The *Online Grades* application will communicate (interface) with 5 different systems:

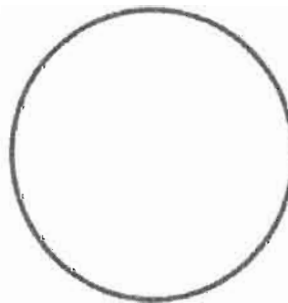
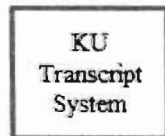
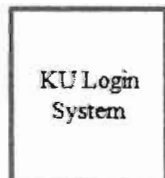
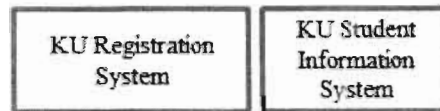
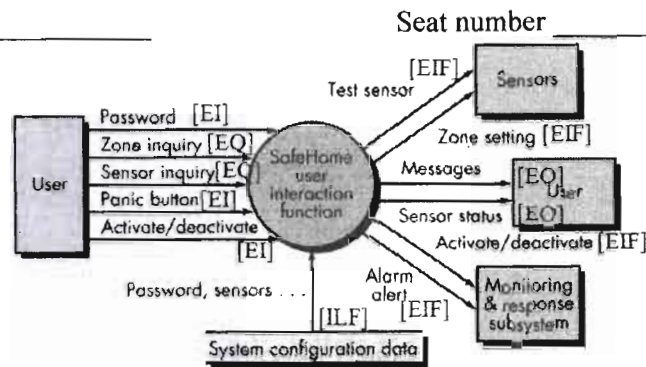
1. Single Sign-on KU Login System. This has 2 related web services (API's):
  - a. verify\_login web service. *Input:* User Name, Password. *Output:* Login Success (yes/no), Error Message.
  - b. set\_password web service. *Input:* User Name, Password. *Output:* Change Success (yes/no), Error Message.
2. KU Registration System. This has 2 related web services:
  - a. get\_registered\_students\_list web service. *Input:* Course Code, Semester, and Array of Section Numbers. *Output:* Array of {Student ID, Student Name} registered for that course, semester, and section numbers, Success (yes/no), Error Message.
  - b. find\_courses\_offered web service. *Input:* Department and Semester. *Output:* Array of {Course Code, Course Name, Section Numbers} offered in that semester by that department, Success (yes/no), Error Message.
3. KU Transcript System. This has set\_grade web service. *Input:* Course Code, Semester, Student ID, Grade. *Output:* Success (yes/no), Error Message.
4. KU Student Information System. This has get\_student\_email web service. *Input:* Student ID. *Output:* Student Name, Email, Success (yes/no), Error Message.
5. Gmail Email Service with send\_text\_mail API. *Input:* Send to Email Address, Subject, Text Message. *Output:* Send Success (yes/no), Error Message.

**An Instructor User can:**

- Enter data into login (query) form of this application. The application calls Login System's verify\_login service to verify the login. If login is successful, the user may continue to do other functions listed below.
- Enter data into password change form which asks for this user's old password and new password 1, new password 2 (2 times). The *Online Grades* application checks that new password 1 equals new password 2 before continuing. Then, Login System's verify\_login service is used to check that the old password is correct and then the new password is set in the Login System by the set\_password service.
- Choose Department and Semester in a query screen to get a list of Courses/Sections offered from Registration System's find\_courses\_offered web service.
- Choose Course code, Semester, and 1 or more Sections in a query screen to get a list of students registered from Registration System's get\_registered\_students\_list web service. This data appears on screen and upon pressing [Save to Grade Sheet] button it can automatically be saved into the Course Grade Sheet data described below.
- Enter Course Grade Sheet form with header Course Code, Semester. Line item contains Student Code, Student Name, Section Registered, and Grade Received. Instructor puts the grade received for each student here. This information is kept in *Online Grades* application's MySQL database. Note that the data in this form may come from 1) user data entry or 2) party automatically entered by data from get\_registered\_students\_list web service described in the previous step. The user may press the [Print Sheet] button to print the grade sheet via PDF file as a printed report for personal records.
- Upon grade submit by pressing [Submit] button in Course Grade Sheet form, *Online Grades* will
  1. Update the transcript for each student by calling the Transcript System's set\_grade service and
  2. Also send an automatic email to each student to inform him/her about this course's grade. The email address for each student is found in Student Information System's get\_student\_email web service. Each email is sent via calling the Gmail Email Service's send\_text\_mail API.

Name \_\_\_\_\_

1.1 25 points. Complete the architectural context diagram for the *Online Grades* system below, using the *SafeHome* example shown here. Label each arc as EI, EQ, EO, EIF, or ILF. Hint: Query screen (for report or view) is called EQ, external software interfaces are called EIF, reports and views are EO's, user interface forms or data sent from another application for data to be used/displayed/saved locally or internally by *Online Grades* are called EI, and stored data are called ILF.



1.2 5 points. Assume we have the following from part 1 above, compute the FP for this project. You must show your work to get credit.

- 2 complex EI's and 1 simple EI's
- 3 complex EO's, 1 average EO
- 2 average EQ, 3 simple EQ
- 1 average ILF
- 1 complex EIF's, 2 average EIF

Name \_\_\_\_\_

Seat number \_\_\_\_\_

Weighting Factor Table:

Information Domain Value	Weighting Factor		
	Simple	Average	Complex
External Inputs (EI's)	3	4	6
External Outputs (EO's)	4	5	7
External Inquiries (EQ's)	3	4	6
Internal Logical Files (ILF's)	7	10	15
External Interface Files (EIF's)	5	7	10

Information Domain Value	Count	×	Weight	=	Total
Complex EI		×		=	
Simple EI		×		=	
Complex EO		×		=	
Average EO		×		=	
Average EQ		×		=	
Simple EQ		×		=	
Average ILF		×		=	
Complex EIF		×		=	
Average EIF		×		=	
<b>Count Total:</b>					

1. Requires backup and recovery? 4
2. Need specialized data communication? 3
3. Has distributed processing functions? 3
4. Is Performance critical? 4
5. Run in an existing, heavily utilized operational environment? 3
6. Requires online data entry? 5
7. Online data entry requires input over multiple screens / operations / tabs (line items)? 1
8. Are the ILF's (database) updated online? 4
9. Inputs, outputs, files, or inquiries complex? 2
10. Internal processing complex? 2
11. Code designed to be reusable? 4
12. Conversion and installation included in the design? 2
13. System designed for multiple installations in different organizations? 0
14. Application designed to facilitate change and ease of use by user? 3

Note:  $FP = count\_total \times [0.65 + 0.01 \times \sum_{i=1}^{14} F_i]$

Answer. FP = \_\_\_\_\_

(You must show your work to get credit)

Name \_\_\_\_\_

Seat number \_\_\_\_\_

## **Part II: Questions on Requirement Analysis**

The Child Care Management (CCM) software is intended to provide a computer based system that will assist in managing a child care center. Many of the typical functions involved in operating a center will be automated through software to improve the operational workflow within a facility. For instance, activities like tracking child immunizations and maintaining classroom waiting lists will be performed by the computer system so that employees can spend more time caring for the children. In addition, tasks like processing invoices and printing customer reports will be available within the program to minimize the time that administrative staff must spend creating these documents. This Requirements Specification will describe these as well as many other features of the software in greater detail.

This section contains a general description of the software functionality followed by detailed requirements that will be traced throughout the project. Before gaining access to the CCM system an employee will be required to enter their user name and password. An employee's access privileges within the system are determined by their job classification. The administrators will have unlimited access whereas teachers and assistants will have fewer privileges as described below.

Administrators are responsible for registering new customers so they are the only employees allowed to view or edit all account information. When a parent contacts the Care Center to enroll a child an administrator will first check classroom availability. If the classrooms for the child's age group are already full the child is placed on the classroom waiting list. The administrator will then create an account if it is a new customer or edit an existing account for a returning customer.

As the children arrive in the morning the teaching assistant will record the time of their arrival. Likewise when the children leave for the day the assistant will record the time of their departure. The departure time will be used to keep track of late pick-ups so the parent can be billed accordingly. If a parent is unable to pick up their child they may send another person, but only if the person had previously been designated as an authorized pick-up. The names of all authorized pick-ups are maintained in a child's record for this purpose.

One of the teacher's responsibilities is to document the behavior of children they supervise. The CCM system will store this information in a database for future reference. This is especially useful for parent teacher conferences. Teachers will have the ability to add or edit their comments at any time.

Administrators can access a reporting feature that generates preformatted documents summarizing key customer information. In addition to printing these reports administrators are able to print invoices. Invoices will include a special notice if a child is due for a required immunization. Customers will be billed on the last day of every month with a discount applied to those accounts having multiple children enrolled in the Care Center.

Daily reminders are a feature that all employees have access to. An employee can enter the date of an event as well as a message describing the event. On the day of the reminder a pop up message will be displayed when the employee logs onto the system. Acknowledgement of the reminder will permanently remove it from the database.

### **2.1 5 points Describe a set of possible deliverables and constraints of the Child Care Management System mentioned above.**

Name \_\_\_\_\_

Seat number \_\_\_\_\_

**2.2 10 points Draw a use case diagram that gives an overview of the above system requirement.**

Name \_\_\_\_\_

Seat number \_\_\_\_\_

**2.3 15 points** Draw an activity diagram (with swimlanes) that describes the process from when a child arrives at the Care Center until the time a child left the center with an authorized pick-up person.

Name \_\_\_\_\_

Seat number \_\_\_\_\_



Name \_\_\_\_\_

Seat number \_\_\_\_\_

**Part III: 10 points Questions on Software Processes**

A consumer company, called Food & Life group, has multiple businesses in food, hotel & spa, and consumer products. Food & Life owns an in-house software development team of 100 staff members in the IT department (programmers, testers, system analysts, project managers). These IT personnel are divided into multiple sub-teams and each team is responsible for the development and maintenance of Food & Life software suite. The type of software handled by the IT department includes ERP software and e-commerce websites.

You are hired as a new IT manager for Food & Life. Your job is to improve the efficiency and effectiveness of the IT department. Every software team is currently adopting the conventional software process, namely, Rational Unified Process. All teams are currently working collaboratively in the scheduled software release. Describe how you can gradually introduce the Scrum process into this environment without a major interruption to the software development work.

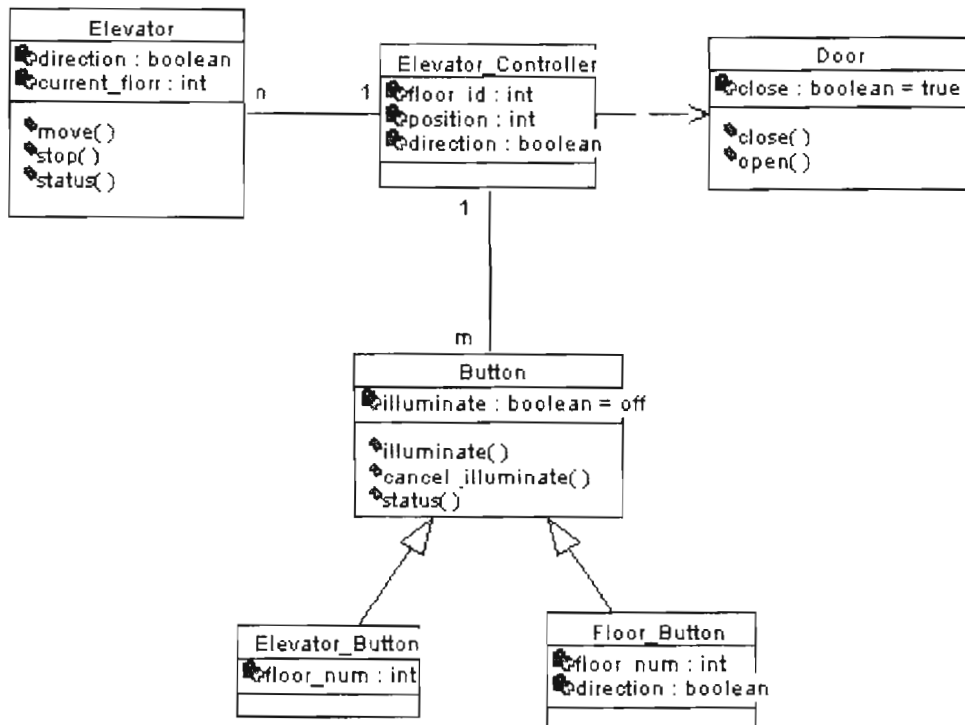
Name \_\_\_\_\_

Seat number \_\_\_\_\_

**Part IV: Software design. (30 points)**

**4.1 10 pts** What is the relationship between a software analysis model, a design model, and code implementation?

**4.2 10 pts** Consider the following class diagram describing an elevator control system.



Translate information given by the class diagram into a requirement description of the elevator control system.

Name \_\_\_\_\_

Seat number \_\_\_\_\_

**4.3 10 pts** Imagine a web application for product ordering system, where a registered customer can check for product item availability in the inventory database before making an order. **Draw a component diagram to show an architectural overview of this system.**