CS 2310: Multimedia Software Engineering
Exercise 1

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Requirement

The purpose of this exercise is to experiment with patterns in software engineering. (a) Use the IC cards to specify the activities involved in organizing a personal health care system such as processing sensor input from blood pressure meter, body temperature, heart rate and so on, scheduling routine and non-routine appointments with physician, obtaining and processing prescriptions, following up test results and so on. (b) Can you identify certain patterns from the above activities? Describe some of the patterns you have identified.

1 Activities involved in organizing a personal health care system

The general pipelines for organizing a personal health care system is shown below. The corresponding IC cards are demonstrated in the following parts.

- Schedule an appointment before going to the hospital
  - Schedule routine appointment
  - Schedule non-routine appointment (Emergency)
- Update medical records
- Examine patient symptoms
- Collect sensor data
  - Check blood pressure
  - Check blood sugar level
  - Check body temperature
  - Check heart rate
- Perform diagnosis
- Provide appropriate treatment
  - Prescribe medicines as treatment
    - Get to pharmacy for medicines
  - Get surgery as treatment
  - Transfer to higher level medical institutions
• Schedule follow-up test
• Handle Paperwork

**IC Card**

**IC Name:** Schedule routine appointment

**Description:** Regular patients need to make routine appointments

**Interaction Pattern:**

![Interaction Pattern]

By Others with Interaction

**Time Critical Condition:** none
**Name of Other IC:** Routine Appointment scheduling system
**Message to Other IC:** Request for making a routine appointment
**Other IC's Task:** Accept the request and assign a time slot
**Card 1 of 1 (if necessary please use several IC cards to describe an IC)**

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**IC Card**

**IC Name:** Schedule non-routine appointment

**Description:** Patients in emergency need immediate treatment

**Interaction Pattern:**

![Interaction Pattern]

By Others with Interaction

**Time Critical Condition:** as soon as possible
**Name of Other IC:** Emergency appointment scheduling system
**Message to Other IC:** Request to jump the queue and get immediate treatment
**Other IC's Task:** Accept the request and assign medical staff immediately
**Card 1 of 1 (if necessary please use several IC cards to describe an IC)**

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**IC Card**

**IC Name:** Update medical records

**Description:** Update medical records for the patients

**Interaction Pattern:**

![Interaction Pattern]

By Myself with Interaction

**Time Critical Condition:** none
**Name of Other IC:** Medical records storage system
**Message to Other IC:** Request to update or add new records
**Other IC's Task:** Processing update request
**Card 1 of 1 (if necessary please use several IC cards to describe an IC)**
IC Card  
**IC Name:** Examine patient symptoms

**Description:** Examine patient symptoms to help diagnosis

**Interaction Pattern:**

```image

😊
```

By Myself with Interaction

**Time Critical Condition:** During the patient appointment time

**Name of Other IC:** Patients being examined

**Message to Other IC:** Inquiry about patient feelings and observed symptoms

**Other IC’s Task:** Respond accurately according to the actual symptoms

**Card 1 of 1** (If necessary please use several IC cards to describe an IC)

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IC Card  
**IC Name:** Collect sensor data

**Description:** Collect data from various sensors to monitor patient status

**Interaction Pattern:**

```image

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```

Mixed

**Time Critical Condition:** None

**Name of Other IC:** Multiple sensors

**Message to Other IC:** Request to obtain sensor data

**Other IC’s Task:** Get certain data from patient and report back

**Card 1 of 1** (If necessary please use several IC cards to describe an IC)

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IC Card  
**IC Name:** Check blood pressure

**Description:** Check the blood pressure of the patient

**Interaction Pattern:**

```image

😊 😊
```

By Myself with Interaction

**Time Critical Condition:** In a few minutes (to reflect current status)

**Name of Other IC:** Blood pressure monitor

**Message to Other IC:** Request for current blood pressure data

**Other IC’s Task:** Detect patient blood pressure

**Card 1 of 1** (If necessary please use several IC cards to describe an IC)
**IC Card**

**IC Name:** Check blood sugar level

**Description:** Check the blood sugar level of the patient

**Interaction Pattern:**

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By Myself with Interaction

**Time Critical Condition:** in a few minutes (to reflect current status)

**Name of Other IC:** Blood sugar level monitor

**Message to Other IC:** Request for current blood sugar level data

**Other IC's Task:** Detect patient blood sugar level

Card 1 of 1 (If necessary please use several IC cards to describe an IC)

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**IC Card**

**IC Name:** Check body temperature

**Description:** Check the body temperature of the patient

**Interaction Pattern:**

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By Myself with Interaction

**Time Critical Condition:** in a few minutes (to reflect current status)

**Name of Other IC:** Body temperature metre

**Message to Other IC:** Request for current body temperature

**Other IC's Task:** Measure patient body temperature

Card 1 of 1 (If necessary please use several IC cards to describe an IC)

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**IC Card**

**IC Name:** Check heart rate

**Description:** Check the heart rate of the patient

**Interaction Pattern:**

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By Myself with Interaction

**Time Critical Condition:** in a few minutes (to reflect current status)

**Name of Other IC:** Heart rate monitor

**Message to Other IC:** Request for current heart rate data

**Other IC's Task:** Measure patient heart rate

Card 1 of 1 (If necessary please use several IC cards to describe an IC)
**IC Card**

IC Name: Provide appropriate treatment

Description: Based on patient status give appropriate suggestions for treatment.

Interaction Pattern:

Mixed

Time Critical Condition: During the appointment
Name of Other IC: Other medical staff and patients
Message to Other IC: Suggest various treatment to patients
Other IC’s Task: Perform actual treatment
Card 1 of 1 (if necessary please use several IC cards to describe an IC)

**IC Card**

IC Name: Prescribe medicines as treatment

Description: Doctors give prescription list to patients

Interaction Pattern:

Mixed

Time Critical Condition: During the appointment time
Name of Other IC: Patients need to be cured
Message to Other IC: Detailed medicines needed to cure the disease
Other IC’s Task: Go to pharmacy to get the medicines
Card 1 of 1 (if necessary please use several IC cards to describe an IC)

**IC Card**

IC Name: Obtain medicines from pharmacy

Description: Go to pharmacy to purchase medicines on prescriptions

Interaction Pattern:

Mixed

By Others with Interaction

Time Critical Condition: The sooner the better (early cure)
Name of Other IC: Pharmacist in charge of pharmacy
Message to Other IC: Request for medicines listed on prescriptions
Other IC’s Task: Double check the list and provide the medicines
Card 1 of 1 (if necessary please use several IC cards to describe an IC)
IC Card

IC Name: Perform surgery as treatment

Description: If needed surgery is performed to cure patients
Interaction Pattern:

😊

By Myself with Interaction

Time Critical Condition: Before it becomes too late
Name of Other IC: Patients to be cured
Message to Other IC: Give details about performing surgery
Other IC's Task: Approve or reject such treatment suggestions
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Transfer to higher level hospital

Description: Patient in bad condition and needs to be transferred
Interaction Pattern:

😊

Mixed

Time Critical Condition: as soon as possible
Name of Other IC: Emergency system in higher level medical institutions
Message to Other IC: Condition of the patient and the reason of transfer
Other IC's Task: Accept the patient and give immediate emergency care
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Schedule follow-up test

Description: Schedule follow-up test for patients if necessary
Interaction Pattern:

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By Myself with Interaction

Time Critical Condition: none
Name of Other IC: Doctors in charge of the patients and patients
Message to Other IC: Available time slot for follow-up test
Other IC’s Task: Acknowledgement
Card 1 of 1 (If necessary please use several IC cards to describe an IC)
2 Patterns identified from activities

2.1 Complicated tasks can be decomposed for easier solutions

The most obvious pattern is the decomposition of complicated tasks. In fact, we notice that for many difficult tasks more than one IC Cards are needed because the goal can only be achieved by collaborations. For examples, in the personal health care system design, collecting sensor data is not trivial because more than one sensors are needed. To finish the task, we split the higher level tasks into smaller ones, aka. collecting blood pressure, blood sugar level, heart rate, etc. In this way the tasks can be handled by individual sensors and the results can be obtained from corresponding sensors. This pattern can be formulated in the following form.

**Problem**
Current patient status is needed to help the diagnosis

**Context**
Patient status is reflected by various data, like blood pressure, blood sugar level, heart rate, etc

**Solution**
Use multiple sensors to collect individual data

2.2 Agents collaborate and work together to solve tough tasks

We also notice that in complicated tasks more than one IC cards are needed to collaborate on one single task. In this case, it’s relatively hard to define the interaction pattern from the given list. For example, when a patient in bad condition needs to be transferred to higher level medical institutions, not only the local doctors and patients are involved, the medical staff in higher level medical institutions are also needed to cooperate with the transferring. In addition, the billing system and scheduling system need corresponding information to correctly handle such situations. In this case, the interactions become much more complicated. This pattern can be formulated in the following form.

**Problem**
Patient in bad condition needs better treatment and needs to be transferred to higher level hospitals

**Context**
More than one agents are involved in the complicated situations and interactions are hard to define
Solution
Contact multiple agents to collaborate on the task

2.3 Prerequisites need to be completed before further tasks

Another pattern is that certain protocols need to be followed in a chronological order. Specifically, the general pipelines for the personal health care systems develops as “Scheduling” -> “Examine” -> “Collect essential sensor data” -> “Corresponding treatment” -> “Followup appointment” -> “Billing and Insurance”. Some procedures can occur in parallel, such as collecting various sensor data but the others are required to be performed in this order. For example, the treatments can only be determined when necessary examinations have been performed and necessary sensor data have been collected, because the decision are based on these test results. This pattern can be formulated in the following form.

Problem
Multiple procedures need to be completed and some are prerequisites for others

Context
Some activity relies on the result of previous activities thus it can only be decided when the prior results are available

Solution
Logically schedule the entire pipelines in a reasonable way