CS2310: Exercise 2

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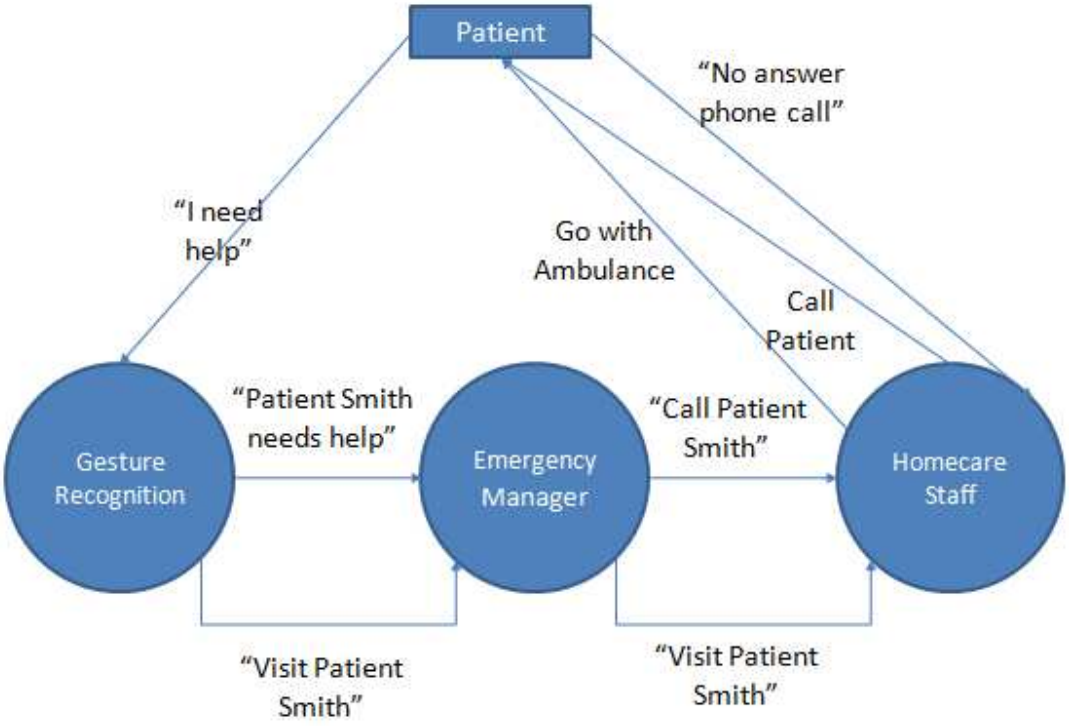
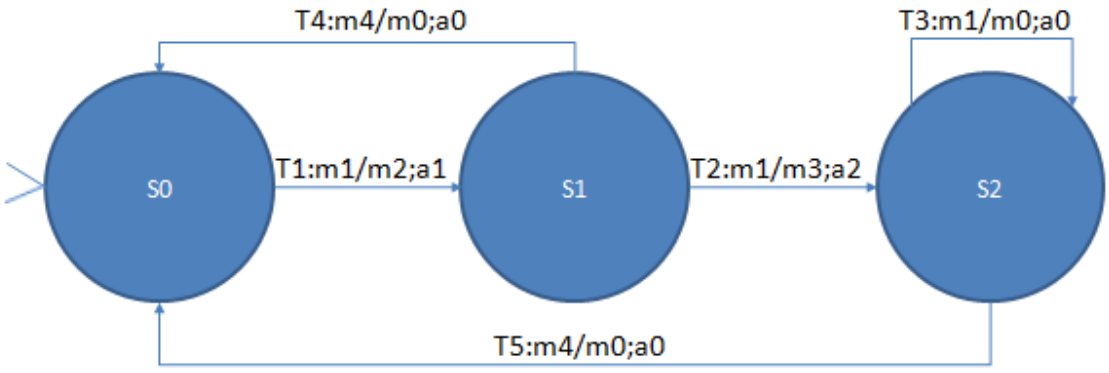
Part a. Draw a state-transition diagrams to define graphically the three index cell types.

First, we are going to draw a more general graph shown in Figure 1. Then, more detailed graphics for each component of figure 1 are shown in Figure 2, 3 and 4.



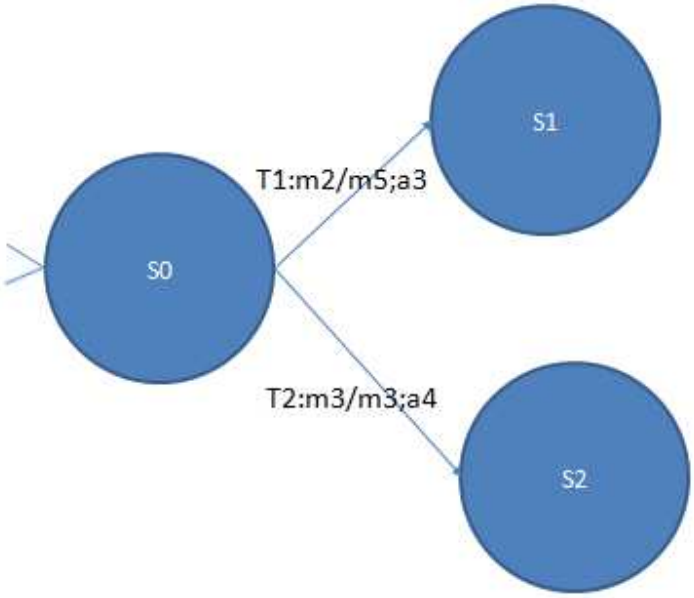
Let's start with the index cell of **Gesture Recognition (GR)**, and it will be:



Where:

- m0 = null message
- m1 = "I need help"
- m2 = "Patient **X** needs help"
- m3 = "Visit Patient **X** "
- m4 = "timeout"
- a0 = no action
- a1 = Send m2 to the Emergency Manager
- a2 = Send m3 to the Emergency Manager

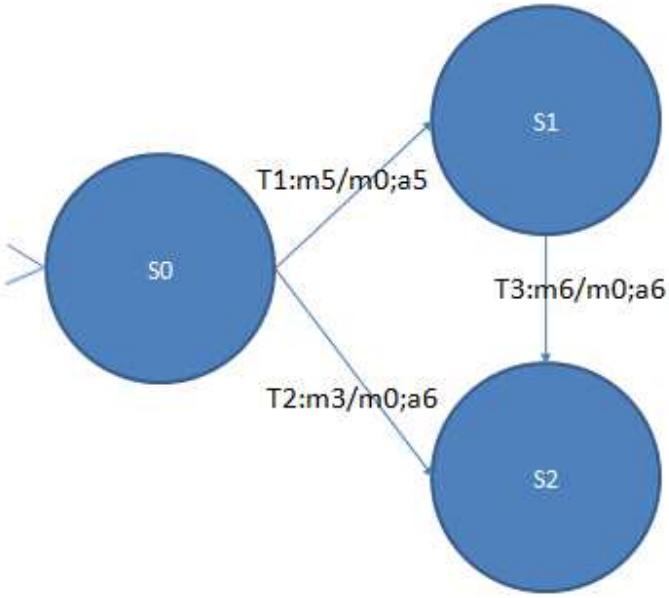
Let's continue with the index cell of **Emergency Manager (EM)**, and it will be:



Where:

- m2 = "Patient **X** needs help"
- m3 = "Visit Patient **X** "
- m5 = "Call patient **X** "
- a3 = Send m5 to the Homecare Staff
- a4 = Send m3 to the Homecare Staff

Let's continue with the index cell of **HomeCare Staff (HCS)**, and it will be:



Where:

- m3 = "Visit Patient **X** "
- m5 = "Call patient **X** "
- m5 = "No phonecall answer"
- a5 = Call Patient **X**
- a6 = Go with ambulance to the patient **X** house

Part b. Specify the three index cell types formally using mathematical notations ic = (X, Y, S, s_0, A, t_max, f, g)

For the **Gesture Recognition (GR)** Cell:

- X = {m1, m4}
- Y = {m0, m2, m3}
- S = {S0, S1, S2}
- S0 = {S0}
- A = {a0, a1, a2}
- t_max is infinite
- f
    - f(m1,S0)=1
    - f(m1,S1)=1
    - f(m4,S1)=1
    - f(m1,S2)=1
    - f(m4,S2)=1

- g
    - g(m1,S0)=(EM, m2, S1, a1)
    - g(m1,S1)=(EM, m3, S2, a2)
    - g(m4,S1)= (null, m0, S0, a0)
    - g(m1,S2)= (null, m0, S0, a0)
    - g(m4,S2)=(null, m0, S0, a0)

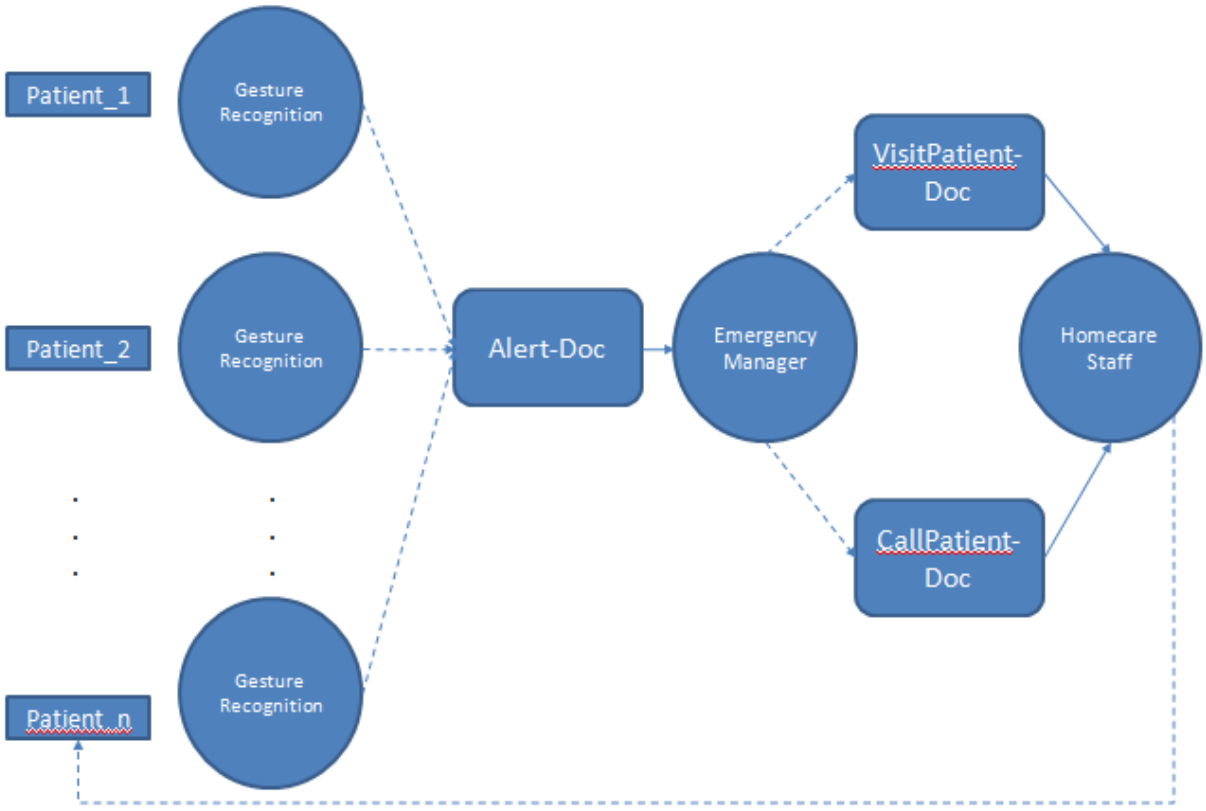
For the **Emergency Manager (EM)** Cell:

- X = {m2, m3}
- Y = {m3, m5}
- S = {S0, S1, S2}
- S0 = {S0}
- A = {a3, a4}
- t_max is infinite
- f
    - f(m2,S0)=1
    - f(m3,S0)=1
- g
    - g(m2,S0)=(HCS, m5, S1, a3)
    - g(m3,S0)=(HCS, m3, S2, a4)

For the **HomeCareStaff (HCS)** Cell:

- X = {m3, m5, m6}
- Y = {m0}
- S = {S0, S1, S2}
- S0 = {S0}
- A = {a5, a6}
- t_max is infinite
- f
    - f(m5,S0)=1
    - f(m3,S0)=1
    - f(m6,S1)=1
- g
    - g(m5,S0)=(null, m0, S1, a5)
    - g(m3,S0)=(null, m0, S2, a6)
    - g(m6,S1)=(null, m0, S2, a6)

Part c. Draw a diagram showing three multimedia interfaces (webpages such as doc1, ..., doc3) enhances with the index cells to illustrate how these index cells work together to form an active index system.



Notice that the tick line denotes a message and the dotted line an action. So, as a first step, the Gesture Recognition will write the information (**messageM1**, **patientID**) to a table **T1** in the database. In this case messageM1 could be "Patient needs help" or "Visit Patient".

Then, Alert-Doc webpage will access the table **T1** and extract the **messageM1** and **patientID**, next, Alert-Doc will pick the personal information (**patient_name**, **patient_addres** and **patient_phonenumber**.) of the Patient using **patientID** and send a message to the Emergency Manager that contains **messageM1**, **patient_name**, **patient_addres** and **patient_phonenumber**.

After that, Emergency Manage will receive a message from Alert-doc and if the field **messageM1** is "Patient needs help", it will add an entry to the table **T2** with the fields **patient_name** and **patient_phonenumber.** In other case, if **messageM1** is "Visit Patient", it will add an entry to the table **T3** with the fields **patient_name** and **patient_address.**

Finally, it will be 2 options. The first one is that callPatient-Doc will access table **T2**, extract the **patient_name** and **patient_phonenumber** and send the message "call **patient_name** at the phone number **patient_phonenumber**" to homecare staff. Finally, the homecare staff will call the patient. And the second one is that visitPatient-Doc will access table **T3**, extract the **patient_name** and **patient_address** and send the message "visit **patient_name** at the address **patient_address** with the ambulance". Finally, the homecare staff will visit the patient.

Part d. Following the discussion on the concept of patterns, define more clearly the pattern(s) you have identified. If you fell the patterns you have identified are lacking in certain respect, you may replace them by some new patterns.

For each pattern we are going to associate a problem (P), context (C) and solution (S). And, the identified patterns are:

Pattern: TakeCareOfSeniorCitizen(P, C, S)
Problem: how to take care of senior citizens?
Context: To take of senior citizens alone at home
Solution: Recognize an emergency signal, communicate to the emergency manager (hospital) and help the patient

Pattern: RecognizeEmergencySignal(P, C, S)
Problem: how to recognize a emergency signal?
Context: The emergency signal should be a gesture and it will be recognized with a camera
Solution: Recognize a gesture using an image processing system

Pattern: CommunicateEmergencyManager(P, C, S)
Problem: how to communicate with the emergency manager?
Context: The camera will have a wifi connection (internet access)
Solution: The camera could create an entry to a database in the internet, and then a webpage using the information of the database can send a message to the Emergency Manager

Pattern: HelpThePatient(P, C, S)
Problem: how to help a patient?
Context: The ambulance that will help the patient will be at no more than 10 minutes driving. Notice also that if there's no answer of the patient, the homecare staff will send an ambulance.
Solution: The emergency manager receive the message and considering it, he/she will ask the homecare staff to call or visit the patient

Part e. A visual specification of the identified pattern(s) should be included, using for example visual grammar rules.

A visual grammar G is composes as (http://people.cs.pitt.edu/~chang/365/elements.html)

G = (N, X, OP, s, R)

where **N** is the set of nonterminals, **X** is the set of terminals (icons), **OP** is the set of spatial relational operators, **s** is the start symbol, and **R** is the set of production rules whose right side must be an expression involving relational operators.

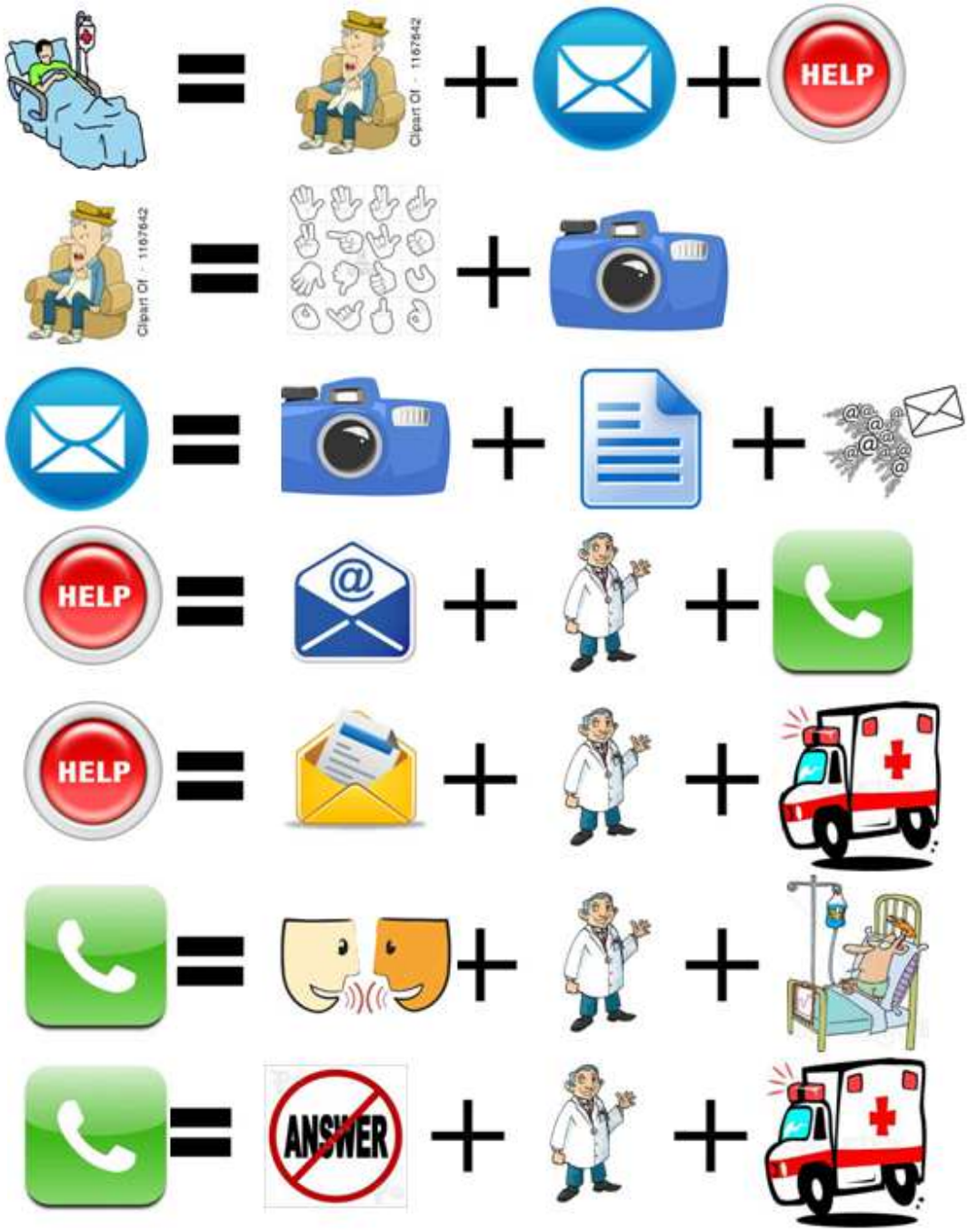
So, let's describe our grammar. First, **N** is the following nonterminals:

Where the first one means *TakeCareOfSeniorCitizen*, the second one is *RecognizeEmergencySignal*, the third one is *CommunicateEmergencyManager,* the fourth one is *HelpThePatient* and finally, the last one is *CallPatient*.

Second, **X** is the following terminals and they will be described in the production rules **R**

Related to the operators **OP,** we are going to use the symbol (+) and in each rule we are going to explain how the elements are related. Then, our star symbols (**s**) is

Finally, the productions rules (**R**) are:



Where, the first rule means that to take care of a senior citizen we are going to Recognize an Emergency Signal, Communicate with the emergency manager and help the patient. The second rules is how we are

going to recognize a emergency signal, so to do this we need to recognize a gesture using a digital camera. The third one is how we are going to communicate with the Emergency Manager, in this case the camera will have a internet connection, so it will update an entry in a database and then, a webpage will send a message to the Emergency Manager. Next, the fourth and fifth rule are how the emergency manager is going to help a patient. The fourth rule is in the case that he/she receives a "Call" message and the doctor will call the patient and the fifth rule is if he/she receives a "Visit" message and the doctor will go with an ambulance to the patient house. Finally, the two last rules manage the communication to the patient. The seventh one means that the patient answer the call and the doctor helps him with the problem and the eight one means that the patient doesn't answer the phone, so the doctor goes with an ambulance to the patient house.