

SYSC 3120: Software Requirements Engineering

Module 2 Lab Assignment

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Due on Sunday, February 6, 2022 by 11:59PM

This assignment contains 7 pages (including this cover page) and 8 problems. You are responsible for ensuring that your copy of the assignment is complete. Bring any discrepancy to the attention of your instructor.

Special Instructions:

1. **Do as many problems as you can.**
2. Start early as this lab assignment can be much more time consuming than you might initially think!
3. The burden of communication is upon you. Solutions not properly explained will not be considered correct. Part of proper communication is the appearance and layout. If we cannot “decode” what you wrote, we cannot grade it as a correct solution.
4. You may consult outside sources, such as textbooks, but *any use of any source* **must** be documented in the assignment solutions.
5. You are permitted to discuss *general aspects* of the problem sets with other students in the class, but you must hand in your own copy of the solutions.
6. Your lab assignment solutions are due by 11:59PM on the due date and must be submitted on **Brightspace**.
 - Late assignments will be graded with a late penalty of 20% of the full grade per day *up to 48 hours past the deadline*.
7. You are responsible for ensuring that your lab assignment is submitted correctly and without corruption.

Problem	1	2	3	4	5	6	7	8	Total
Points:	2	5	5	5	5	5	18	20	65

The purpose of this lab is to participate in activities related to requirements elicitation and evaluation. In particular, it will exercise your ability to identify pertinent information from an interviewing elicitation activity, as well as your ability to identify and document inconsistencies, prioritize requirements, and conduct risk analyses.

Recall the *CoVax* description from the Module 1 Lab Assignment reproduced below.

CoVax: A COVID-19 Vaccination Information System

The *CoVax* system to be developed is intended to support the day-to-day operations of medical clinics offering support for patients requiring or requesting COVID-19 vaccinations. Most patients that require vaccinations do not require dedicated hospitals but need to attend specialist or ad hoc clinics that can administer the needed vaccinations. *CoVax* is intended to be a medical information system that maintains information about patients and the vaccinations that they require or have received. To make it easier for patients to receive their vaccinations, these clinics are not just run in hospitals. They may also be held in local medical practices, community centres, or local pharmacies. Therefore, the system must be able to accommodate many simultaneous users. *CoVax* aims to generate management information that allows health service managers to assess performance against local and government targets, as well as to provide medical staff with timely information to support patient care. Currently, clinics offering such support operate by accepting walk-in patients (which sometimes contributes to long wait times) and maintaining paper records stored in large filing cabinets in administrative offices. This makes it difficult to share information across clinics and diminishes the level of patient support that can be offered.

Many patients that choose to be vaccinated against COVID-19 simply need to receive the vaccination and a record needs to be kept about their history and the type of vaccine (e.g., Pfizer, Moderna, AstraZeneca, etc.). However, in some cases, patients may have specific medical conditions that require them to receive certain vaccines. These patients are considered to be part of the “*at risk*” group. Conversely, some patients may have specific medical conditions or allergies to certain substances that prevent them from safely receiving certain vaccines.

Users of the system will include clinical staff such as doctors, nurses, and pharmacists. Non-medical users will include receptionists who make appointments, medical records staff who maintain the records system, and administrative staff who generate reports.

The *CoVax* system needs to record information about patients (name, address, age, etc.), medical conditions or allergies, and past vaccines. Reports are generated at regular intervals for medical staff and health authority managers. Typically, reports for medical staff focus on information about individual patients, whereas management reports are anonymized and are concerned with conditions, vaccine supplies and demands, etc.

Clinicians should be able to create records for patients, edit the information in the system, view patient vaccination history, and so on. The system must support the generation of data summaries so that doctors who have not previously met a patient can quickly learn about the patient’s COVID-19 vaccine record and existing conditions. The system should issue warnings if possible problems in records are detected. These checks should be executed automatically on a fixed period. One of the most important elements of the monitoring system is to keep track of patients who are in the “*at risk*” group to ensure that their vaccination records are up-to-date.

The system must generate monthly management reports showing the number of patients vaccinated at each clinic, the number of patients “*at risk*”, the vaccines offered, etc. The system should display this information in a simple, clean, and understandable form.

CoVax must comply with relevant laws on data protection that govern the confidentiality of personal information and health laws that govern vaccinations in a given jurisdiction.

As in all medical systems, privacy is essential. It is essential that patient information is confidential and is never disclosed to anyone apart from authorized medical staff and the patient themselves. *CoVax* is also a

safety-critical system. Some vaccines cause patients to have severe allergic reactions. Wherever possible, the system should warn medical staff about potentially incompatible patients with requested vaccines. CoVax must be available when needed and requests for patient information must be handled immediately; otherwise safety may be compromised, and it may be impossible determine if a vaccine is safe to be administered to a patient.

It should be possible for the CoVax system to be accessed and used from sites that do not have secure network connectivity. When the local systems have secure network access, they use patient information in a central database, but they can download and use local copies of patient records when they are disconnected. The system is not a complete medical records system and so does not maintain information about other medical conditions. However, it may interact and exchange data with other clinical information systems.

The overall budget for the development of this new system is \$525,000. The system must run on Windows and MacOS and mobile devices (such as Android and iOS tablets), all of which are used in the clinics. It must be ready as soon as possible.

Interview Transcripts

Below you will find two fragments of interview transcripts between a Requirements Engineer (RE) and two different stakeholders for the system: a member of the Clinical Staff (CS) and a member of the Administrative Staff (AS):

Interview Transcript with a Clinical Staff Member

RE: What is your vision for this system?

CS: I hope to see a system that I can use to quickly and easily access a patient's vaccine chart. Such a system would undoubtedly increase the quality of patient care. It would also have the potential to make it easier to share information across clinics.

RE: What kind of information is contained in a patient's record?

CS: A chart typically has the patient's personal information including their name, address, age, and the like, as well as any medical conditions or allergies, and past vaccination with the dosage in units (U).

RE: How do you expect to access a patient's record?

CS: I should be able to access a chart from my phone, tablet, or computer from sites that do not have secure network connectivity. In my opinion, this is vital to patient care.

RE: When can patients visit a clinic?

CS: Patients can visit a clinic at any time of the day. Many patients often drop in as walk-in patients.

RE: When do you consider a patient to be "*at risk*"?

CS: Whenever a patient has a medical condition that requires them to receive certain vaccines, it is often prudent to recommend that they be "*at risk*". This allows us to remind patients to keep their vaccinations up-to-date and to ensure they are not administered an incorrect vaccine.

RE: When a patient is in the "*at risk*" group, how is this recorded?

CS: This is noted in the chart with a simple check box. The reasoning for the recommendation is also carefully described in the chart.

RE: Do you have any concerns about the system that we intend to develop?

- CS:** I am wondering if there might be a risk for the patient charts to be compromised in a security breach. The personal information contained in a patient's chart needs to be protected in compliance with data protection laws. If something were to happen that would allow third-parties to obtain that information, I am sure we would probably be looking at fines or lawsuits. I also think it would also be pretty bad if the system crashed and we lost all of the patient charts that we had stored.
- RE:** Is there anything that you think should be incorporated into the system that would help to alleviate these concerns?
- CS:** Maybe we should have a recovery process in place that would allow us to make secure data backups. We could also encrypt the database to eliminate the threat of a security breach. In both cases, I think this could help protect customer information and prevent major loss of our the patient data.

Interview Transcript with an Administrative Staff Member

- RE:** What is your vision for this system?
- AS:** I would really like a system that would reduce my work effort to generate detailed reports for the clinics. I think an automated system could help to assess performance against local and government targets and enable us to reduce the operational costs of each clinic.
- RE:** What kind of information is needed in your reports?
- AS:** We actually generate two kinds of reports, one for the medical staff and one for the health authority managers. In both cases, we extract the basic information contained in the patient's record, including their personal information like their name, address, and age, and a history of their medical conditions or allergies and past vaccinations with the dosage in ELISA units (EL.U.). Typically, reports for medical staff focus on information about individual patients, whereas management reports are anonymized and are concerned with things like conditions and vaccine supplies and demands.
- RE:** How do you expect to access a patient's record to generate your reports?
- AS:** In order to generate the reports, we must have secure network connectivity. This will allow us to use our computers to access the records and compile the information needed.
- RE:** When can patients visit a clinic?
- AS:** Patients can visit a clinic during operating hours. Some clinics are open 24 hours a day and others have different hours.
- RE:** When do you consider a patient to be "*at risk*"?
- AS:** If a patient has a specific medical condition or allergy that prevents them from safely receiving certain vaccine, they are considered to be "*at risk*".
- RE:** When a patient is in the "*at risk*" group, how is this recorded?
- AS:** The clinician notes this in the patient record by checking a box and providing their justification for the recommendation.
- RE:** Do you have any concerns about the system that we intended to develop?
- AS:** I am worried that if the system doesn't work the way we want it to, we will have inconsistent data in our reports, or that patient records will be lost. This could really decrease the quality of patient care and could result in missing government targets that could lead to a prolonged pandemic. I am also a little bit worried that the system will crash which will make generating our reports impossible which may increase operating costs.

- RE:** Is there anything that you think should be incorporated into the system that would help to alleviate these concerns?
- AS:** I suppose if the system crashed, we could just revert to keeping paper records as backup. If we could have the system automatically check for consistency of the data, then I think that would help to ensure there are no inconsistencies in our reports.

Important Note

Remember that some important information may not necessarily be stated explicitly in the provided interview transcripts! Because you may have to add missing information or clarify requirements, try to always make reasonable assumptions. Please ensure that your assumptions are clearly and properly documented, and that they are reasonable for the given system.

Submission Requirements

Please read the following instructions very carefully and follow them precisely when submitting your assignment!

The following items are required for a complete assignment submission:

1. **PDF Lab Assignment Solutions:** Submit a detailed document that carefully and concisely describes your solutions to the problems in this lab assignment. Please ensure that your document is well-organized and that the problem numbers and sub-parts are clearly provided to facilitate the grading of your solutions.

Grading Notes

An important part of this lab assignment is following instructions. As such, the following grade **penalties** will be applied for failure to comply with the submission requirements outlined above:

- Failure to submit the Lab Assignment Solutions will result in a grade of 0 for the assignment.
- Failure to submit the Lab Assignment Solutions in the required format (PDF) will result in deduction of 5% of the full grade of the assignment.

Problem 1 [2 points]

With respect to the CoVax description on Page 2 and the interview transcripts provided on Page 3, identify the scope of the CoVax to be built. Be sure to explicitly, and concisely, state what the system will, and, if necessary, will not do.

Problem 2 [5 points]

With respect to the CoVax description on Page 2 and the interview transcripts provided on Page 3, identify as many relevant stakeholders for the CoVax as you can. Justify your selections. There are at least five stakeholders.

Problem 3 [5 points]

With respect to the CoVax description on Page 2 and the interview transcripts provided on Page 3, identify as many relevant business events for the CoVax as you can. There are at least five business events.

Problem 4 [5 points]

With respect to the interview transcript provided on Page 3, identify as many relevant viewpoints as you can for the CoVax. Justify your selections. There are at least five viewpoints.

Problem 5 [5 points]

Using the interview transcripts from the two stakeholders starting on Page 3, identify at least one example of each of the five types of inconsistencies.

Problem 6 [5 points]

Given the following set of statements, construct an interaction matrix to count the number of conflicts and the number of non-conflicting overlaps for each statement.

1. The system shall generate reports showing the number of patients vaccinated at each clinic, the number of patients “*at risk*”, and the vaccines offered, whenever needed.
2. The system shall record information about patients (name, address, age, etc.), medical conditions or allergies, and past vaccinations.
3. The system shall compute the number of patients that are in the “*at risk*” group.
4. The system shall estimate the required vaccine supplies and demands.
5. The system shall generate reports on the first day of each month.

Problem 7 [18 points]

The following scribbled notes have been gathered as a result of a group session with stakeholders for the CoVax system:

- Rqmt 1: system shall have graphical user interface – cost est.: \$50K, system would be too difficult to use without, must have!
- Rqmt 2: system shall remind patients of booked appointments – not costly (likely), would significantly add to patient care
- Rqmt 3: system shall generate detailed clinic stat reports for staffing – could cost \approx \$20K, might add to patient care and satisfaction, not strictly needed
- Rqmt 4: system shall interface with EHR infrastructure – not sure if necessary, can get by without, cost estimated \$100K

- Rqmt 5: system shall compute report data (e.g., # patients vaccinated) – cost reasonable \approx \$20K, very useful to have, help business operations
- lower cost preferred over value!

You have been asked to prioritize the requirements to determine which *three* of the five you should implement. Based on the information gathered from the group session, use the Analytic Hierarchy Process to prioritize the requirements as high, medium, and low. Provide a value-cost diagram partitioned into three subareas (assume reasonable partition boundaries). Based on the results of your analysis, clearly state your recommendation of the three requirements that should be implemented.

Problem 8 [20 points]

Use your imagination and provide a sample of DDP risk management for the *CoVax* system. You may use the interview transcripts provided on Page 3 to help identify potential risks, consequences, and countermeasures. Note that you should have at least four risks, consequences, and countermeasures that are reasonable for the *CoVax* system. Choose reasonable likelihoods, weights (should add to 1.0), impacts, and reductions for the risk-consequence table and the risk-countermeasure table. Do all calculations and provide appropriate comments to compute the criticality of each risk, the potential loss of each objective, the combined risk reduction for each risk, and the overall effectiveness of each countermeasure.

END OF LAB ASSIGNMENT
