

# Software Requirements Engineering (SE2001)

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Course Instructor(s)

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Section

Ali

Student Signature

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Attempt all the questions.

1. Provide solutions on the page numbers mentioned in the following table:

Question #	1	2	3	4	5
Page # of answer sheet	1, 2	3, 4	5, 6	7, 8	9, 10

2. There are 3 bonus marks for following instruction # 1.

3. Use of a two-sided, handwritten help sheet of A-4 size is allowed. Photocopies are not allowed.

### ***CLO 1: Describe the activities involved in the requirements engineering process***

**Q1:** Sue and Tom Bickford wanted to open their own restaurant but had lack of investment. They noticed that many restaurants offer takeout food, and some restaurant - primarily pizzerias - offer home delivery service. Many people they met, however, seemed to want home delivery service with a wider food selection. The Bickfords conceived Waiters on Wheels (WoW) as the best of both worlds: a restaurant service without the high initial investment. The Bickfords contracted with a variety of well-known restaurants in town to accept orders from customers and to deliver the complete meals. After preparing the meal to order, the restaurant charges WoW a wholesale price, and the customer pays retail plus a service charge and tip. WoW started with only two restaurants and one delivery driver working the dinner shift. Business rapidly expanded, and the Bickford realized they needed a custom computer system to support their operations. They hired a consultant, Sam Wells, to help them define what sort of a system they needed. Conversation between the 3 is given below:

**Sam:** What sorts of events happen during your business that make you decide for a computer based system? Tell me about what usually goes on?

**Sue:** When a customer calls in to order, I need to record it and get the information to the right restaurant. I need to know which driver to ask to pick up the order, so I need drivers to call in and tell me when they are free. Sometimes, customers call back to change their orders, so I need to get my hands on the original order and notify the restaurant to make the change.

**Sam:** Okay, how do you handle the money?

**Tom:** The drivers get a copy of the bill directly from the restaurant when they pick up the meal. The bill should agree with our calculations. The drivers collect that amount plus a service charge and tip. When drivers report in at closing, we add up the money they have and compare it with the records we have. After all drivers report in, we need to create a deposit slip for the bank for the day's total

## Final Exam

Total Time (Hrs): 2.5

Total Marks: 120

Total Questions: 5

receipts. At the end of each week, we calculate what we owe each restaurant at the agreed wholesale price and send each a statement and a cheque."

**Sam:** What other information do you need to get from the system?

**Sue:** It would be great to have some information at the end of each week about orders by restaurant and orders by area of town – things like that. That would help us decide about advertising and contracts with restaurants. Then we need monthly statements for our accountant.

Sam made some notes and sketched some diagrams as Sue and Tom talked. Then after spending some time thinking about it, he summarized the situation for the Computerized Waiters on Wheels by providing a list of events that drive processing, production of information, and storage of information. Sam confirmed the events with Bickford brothers; Sue and Tom agreed with the list of events. After summarizing the situation and before leaving, Sam says, "I also suppose you are going to maintain the information in a database about restaurants and drivers. You will need to do some processing when you add a new restaurant, a restaurant changes the menu, you drop a restaurant, you hire a new driver". Did I get it right? Said Sam. Both Sue and Tom replied in affirmative. After Sam has left, Sue and Tom felt confident they had found the right consultant for the job.

**To do:**

There are seven activities performed during requirements engineering process. Identify and list the requirements engineering activities performed by Sam. Justify your answer by relating the line numbers in the WoW statement and the techniques used by Sam. [20 marks]

### **CLO 2: Apply different requirements elicitation, elaboration, prioritization, and validation tech...**

**Q2:**

**Part a.** Develop a requirements source traceability matrix for at least 10 requirements of the WoW system discussed in the statement of Question 1. No source should be missed. Missing a source will result in deduction of marks. [10 marks]

**Part b.** SNGPL wants its bill correction process automated. Their current process runs as follows:

An SNGPL customer walks in with a bill and contacts the Front Desk (FD). The FD also logs the opening and resolution of this complaint and sends the bill to Customer Support Registrar (CSR) who writes a diary number on the bill and returns the bill to the FD. The FD logs opening of a complaint, records the diary number, date & time of the complaint, writes the complaint number on the bill and returns the bill to the customer. The customer is asked to visit the computer section. The customer visits the computer section and their Receptionist receives the bill from the customer, notes the diary number, bill number, complaint number, date & time, and sends the bill to the Bill Correction Desk (BCD). BCD checks the received readings of the bill in records, corrects the reading on the bill, updates the due amount, signs the bill and returns the bill to the Receptionist. The Receptionist, records the date & time of returning the bill, status of the complaint (i.e. resolved) against the previously recorded diary number and complaint number, returns the bill to the customer and tells the customer to get the correction stamped from the FD. The customer visits the FD and asks for the stamp. The FD stamps the bill, records the date & time of complaint resolution, scans and saves a copy of the corrected bill and returns the corrected bill to the customer.

**To do:** Provide **sequence diagram** for the given scenario. Include all entities involved in the scenario. [10 marks]

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**CLO 3: Write requirements in natural language**

Q3: The pharmacy at the National Hospital fills medical prescriptions for all patients and distributes these medications to the nursing station responsible for the patient's care. The system records the medical prescriptions written by doctors and sends the prescriptions to the pharmacy. A pharmacy technician is shown prescriptions in the system and on the technician's recommendation the prescriptions are sent to the appropriate pharmacy station. For example, the prescriptions for the drugs that must be formulated are sent to the lab station file, prescriptions for off-the-shelf are sent to the shelving station file, and prescriptions for narcotics are sent to the secure station file. At each station, the system allows a pharmacist to determine the appropriateness of the prescriptions by reviewing the relevant prescription file and the patient file (a prescription is appropriate if the dosage is at a safe level and will not negatively interact with the other medications or allergies indicated in the Patient's file). The system then records the pharmacist's observation provided through an order form. If the pharmacist does not fill the order form, the system places the prescription in the pending prescriptions file and prescribing doctor is contacted offline to discuss the situation. In this case, the order may ultimately be filled or the doctor may write other prescriptions depending on the outcome of the discussion. Once filled, a prescription label is generated listing the Patient's name, the drug type and dosage, an expiry date, and any special instructions. The label is pasted on the drug container and the order is sent to the appropriate nursing station. The patient's admission number, the drug type and amount dispenses, and the prescription cost are then sent to the billing department.

F

**To do:** Based on the above description, separately list 5 functional and 5 non-functional requirements for the software system for National Hospital. All requirements should be written in standard format with hierarchical numbering. All requirements should be testable. [20 marks]

**CLO 4: Distinguish between different types of requirements**

Q4: Characterize the following requirements as Functional/Non-functional (F/NF). Also identify if they are Testable or Not-Testable (T/NT). Create a table similar to the following on your answer sheet and then solve the question. In the second last column write F if a requirement is functional and write NF if the requirement is Non-functional. Similarly in the last column write T if a requirement is Testable & write NT if the requirement is not testable. [30 marks]

No.	Requirement	F/NF	T/NT
1	The system shall enable educators to upload lecture videos and assign quizzes to students.	F	T
2	The system shall generate a personalized study plan (PSP) after analyzing the students' quiz results.	F	
3	The system shall complete the quiz analysis and generate the study plan within 24 hours of quiz submission.		
4	The system shall achieve a performance analysis accuracy of at least 85%.		
5	The system shall use the established guidelines to create the PSP.	N.F	T
6	The system shall notify educators when a PSP is ready for review.		NT

7	The system shall present the PSP to the educators for review	F	T
8	The system shall allow educators to annotate the PSPs	F	T
9	The system shall allow students to view the approved PSPs.	F	T
10	The system shall maintain data integrity by frequently taking backups of all updates to the database for every record transaction		
11	The system shall handle a minimum of 10,000 simultaneous users without performance degradation.		
12	The system shall have an uptime of 99.9% to ensure availability.		
13	The system shall provide a responsive user interface, with page load times of less than 3 seconds, to ensure a seamless user experience.		
14	The system shall be accessible almost all the time due to the availability of reliable cloud services (provided by google and amazon)		
15	The system shall perform fine, due to optimize techniques present in node.js and query optimization available in elastic search.		

**CLO 5: Develop software requirements models using appropriate requirements modeling tool**

**Q5:**

**Part a.** CoachingArena (CA) is a place that helps prospective players learn different techniques in their respective sports e.g. golf, badminton, tennis, squash. CA has decided to use technology to help their golf coaches analyse the prospective players' swings while playing a shot. The technology based solution namely Swing Analyser (SA) shall require a player to stand on a sensor-based platform and play a shot in an indoor setting. The cameras mounted at different places in the coaching room shall record the player's moves and send the video stream to the SA system for further analysis. The SA system shall analyse and label the player's postures in the received video stream. The sensors in the platform send the sensors' data to the system so that it analyses and generates a summary of the player's weight on each foot as well as the foot movement while playing the shot. Based on the data from the posture analysis and the sensor analysis, the system simulates the player's movement as well as the trajectory of the golf stick and the ball. Using this trajectory and movement information the system determines the difference between the prospective player's data and the reference players' data available through an existing reference repository by comparing the both data. The SA system generates a report for the coaches based on the results of the comparison. The SA system lets the coaches annotate the swing analysis report and the system shows the annotated report on the screen installed in the report visualization center in the CA where the prospective players are already present.

**To do:** Provide a level 1 data flow diagram for the above scenario. Use the notation discussed in class. Strictly **follow** the notation. Failure to follow the notation will result in deduction of marks.

[10+5=15 marks]

Part b. Consider a chemical tracking system in a lab where chemists can request a chemical and the system returns one container of the requested chemical to the chemist. While fulfilling the requests for the chemicals, the system checks if the chemical is available in the stock or not. If found in stock, the inventory is updated and the chemical is handed over to the chemist. Otherwise, a new order is sent to the vendors from the list available in the vendors' catalogue. Each record is also saved in the respective repository. Level 1 data flow diagram for this system is given in Figure 1.

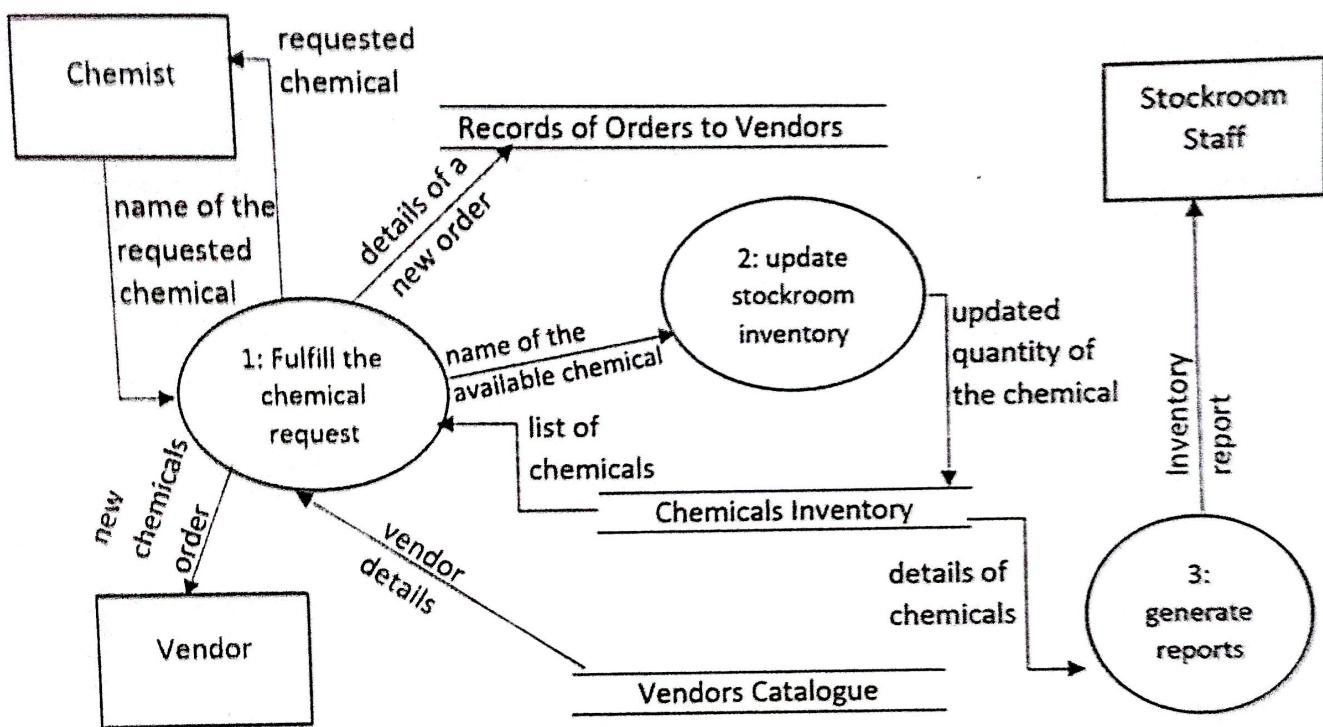


Figure 1: Level 1 DFD for Chemical Tracking System

To do: Identify and list the potentially non-primitive process(es) in figure 1, refine the diagram to level 2 and draw the refined diagram. Strictly follow the notation. Failure to follow the notation will result in deduction of marks. State your assumption(s) clearly.

[5+5+5=15 marks]