Project Hospital Information Systems

COIS 3030H

Software Specifications and Development

Assignment 3

Group 16
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1. Purpose of the Project

a) The Purpose of the Project:
   Problem Statement:

   Peterborough Hospital faces escalating challenges due to the outdated Hospital Information System (HIS), implemented two decades ago. The manual triage system for emergency patients, coupled with labor-intensive insurance document reviews, has led to operational inefficiencies, prolonged wait times, and a backlog affecting the entire hospital.

   The existing HIS, lacking automation, hinders the hospital's ability to adapt to the rising patient load. Urgent intervention is essential to upgrade the system and align it with contemporary healthcare demands. The primary issue lies in the manual processes, causing delays and resource strain.

   The purpose of this project is to implement a modern HIS that automates triage, scheduling, and insurance processes. This overhaul aims to enhance accuracy, speed, and resource allocation, enabling staff to focus on patient care. The anticipated benefits include reduced wait times, improved operational efficiency, and optimized costs.

   This project is vital for Peterborough Hospital to meet evolving healthcare standards, improve patient care, and address the challenges posed by an increasingly demanding healthcare landscape.

b) The Goal of the Project

   Purpose:
   The purpose of the Peterborough Hospital (PH) Hospital Information System (HIS) Upgrade Project is to modernize and enhance the existing information management infrastructure. The goal is to address the limitations of the current system, implemented two decades ago, and create a more robust HIS that aligns with the evolving needs of the hospital. The primary purpose is to improve operational efficiency, streamline patient care processes, and ensure accurate and timely medical attention, ultimately enhancing the overall quality of healthcare services provided by PH.

   Advantages:

   1. Operational Efficiency: Streamline and optimize the allocation of medical personnel, ambulance coordination, and helipad operations to reduce patient wait times and enhance emergency response capabilities.

2. Patient Care Enhancement: Facilitate quicker and more accurate patient assessments, prioritize medical attention based on urgency, and improve the overall patient experience by expediting the registration process and specialist appointments.

3. Resource Optimization: Efficiently schedule and manage medical staff, ambulances, and helicopters, taking into account staff preferences, maintenance schedules, and supply levels to ensure resources are utilized optimally.

4. Comprehensive Patient Records: Maintain detailed and easily accessible historical records of patients, contributing to better-informed decision-making and improved continuity of care.

5. Billing Accuracy: Generate accurate patient bills for insurance companies based on the level of care administered, ensuring fair and timely reimbursement and contributing to financial sustainability.

6. Patient Engagement: Provide patients with limited access to their health-related information, appointment details, and service records, fostering patient engagement and empowerment.

Measurement:

1. Reduced Patient Wait Times: Measure the average time from patient arrival to initial assessment and treatment to ensure a decrease in overall wait times.

2. Enhanced Emergency Response: Evaluate the system's impact on the speed and accuracy of emergency response, measured by the time taken to allocate appropriate medical personnel and resources.

3. Improved Staff Scheduling Efficiency: Assess the effectiveness of the system in aligning medical staff schedules with patient demand, measured by staff adherence to preferred working days and times.

4. Patient Satisfaction: Utilize patient feedback surveys and qualitative assessments to measure the satisfaction levels with the new system's impact on the registration process, appointment scheduling, and overall experience.

5. Accurate Billing and Revenue Increase: Monitor the accuracy of generated patient bills and measure the financial impact through increased and more timely reimbursements from insurance companies.

6. System Accessibility: Evaluate the system's accessibility across various devices, ensuring that it meets the hospital's requirements for usability and convenience.

7. Data Security Compliance: Regularly assess and verify the HIS's compliance with data security standards and privacy regulations, ensuring the protection of patient information.

8. System Implementation Timeline: Measure the project's success by ensuring that the new HIS is fully operational before the target date of May 2024, meeting the hospital's deadline for system deployment.

2. The Stakeholders

a) Internal Stakeholders

S.No.	Stakeholder	Internal/ External	Explanation
1	Peterborough Hospital (PH) Management	Internal	The internal leadership, executives, administrators, and department heads of the hospital are included in this group. They oversee managing the project, assigning resources, and ensuring that the HIS is in line with the strategic objectives of the hospital.
2	Medical Staff (Doctors, Nurses, First Responders)	Internal	Internal stakeholders include clinical staff members including doctors, nurses, and emergency personnel. Every day, they use the HIS to effectively manage patient care, record medical information, and access patient information.
3	Triage Nurses	Internal	The hospital's medical team, including the triage nurses, are vital to the early evaluation of patients. They evaluate patients' health, assign treatment priorities based on urgency, and rely on the HIS for correct data processing.
4	Ambulance and Helicopter Depot Department	Internal	These hospital divisions oversee providing emergency transportation services. They offer suggestions for planning, upkeep, and collaboration with the HIS to guarantee prompt reactions to emergencies.
5	Maintenance and IT Support Staff	Internal	The smooth operation of the HIS following implementation is the responsibility of the hospital's IT support and maintenance personnel. For system dependability and continuing support, they are essential.

b) External Stakeholders

S.No.	Stakeholder	Internal/ External	Explanation
6	Patients	External	Patients are external stakeholders who engage with the services offered by the hospital. They anticipate better interactions with the HIS, including faster wait times, precise billing, and simplified procedures.

7	Insurance Companies	External	As a result of their interest in the HIS for billing and reimbursement purposes, insurance firms are external stakeholders. They should be able to file claims and receive proper billing thanks to the system.
8	Regulatory Authorities	External	External stakeholders include regulatory agencies and healthcare compliance groups. They might establish guidelines and criteria for the HIS that must be followed in order to ensure compliance with regulations.
9	Patients' Families	External	Families of patients are external stakeholders, even if they are not directly involved in hospital activities. They are worried about the standard of care provided to their loved ones and the promptness with which information concerning their status is made available.
10	PatientEase Technologies LTD.	External	External stakeholders include the implementation company, PatientEase Technologies LTD. Its reputation and any future business possibilities depend on its ability to deliver the HIS on schedule and within budget.
11	Government Agencies	External	External stakeholders may include municipal, regional, or federal government healthcare organizations. They might be in charge of ensuring that the HIS abides with healthcare standards and laws.
12	Research Institutions (For example, Trent University)	External	In order to perform medical research, research institutions and universities may need access to de-identified patient data, which makes them external stakeholders in data sharing agreements.
13	Emergency Services	External	`External stakeholders include local emergency services including the police, fire departments, and paramedics. They rely on the HIS to provide them with information in an emergency.
14	Media and Press	External	External stakeholders include media organizations and journalists who cover

			healthcare since they may report on the development of the HIS project and its effects on the neighborhood.
15	Donors (Includes deceased)	External	To donate their organs, donors will use the hospital's services. The HIS would need to determine the compatibility of the organ(s) between the patient and the donor and then approve the transplant based on urgency.
16	Community partnerships	External	The hospital would establish partnerships with numerous organizations. When it comes to the effectiveness/success of the hospital, these groups are also crucial.
17	Pharmaceutical companies/Medical Supply companies	External	They maintain the hospital's pharmaceutical supplies. What medications need to be requested, kept in larger supply, etc., would be tracked by an effective HIS.

3. Mandated Constraints

    a) Platform Constraints-: The solution must be designed and developed to ensure seamless accessibility and functionality across various devices, including PCs, laptops, and handheld devices, aligning with the need for a user-friendly, cross-platform system as specified in the reference.

    b) Partner or Collaborative Applications-: The solution should facilitate integration with external collaborative applications, particularly those related to managing patient insurance documents and billing processes.

    c) Off-the-Shelf Software-: The development of the system should prioritize minimizing the use of off-the-shelf software components to ensure a streamlined booking process that is customized to meet the specific needs of the hospital, as referenced in the requirements.

    d) Schedule Constraints-: The system must be operational by May 2024. The project must strictly adhere to the specified timeline, ensuring that development, testing, and implementation activities are completed within the defined schedule to meet the operational deadline of May 2024.

    e) Budget Constraints-: The project's financial limit is capped at 20 million Canadian Dollars. The entire project, including design, development, testing, and implementation, must be executed within the allocated budget of 20 million Canadian Dollars, as specified in the budget constraints reference.

4. Naming Conventions and Terminology:

- Hospital Information System (HIS): The main system which is to be developed or upgraded.
- Peterborough Hospital (PH): The hospital for which the system requires development.
- Medical Personnel/Medical Staff: Medical personnel comprise all members of the medical team who are competent to give a specific degree of care to a patient, such as doctors, nurses, pharmacists, and other healthcare professionals.
- Triage Nurse: This nurse works in emergency rooms and other emergency clinical facilities to determine what type of treatment patients require and to ensure they are delivered to the appropriate destinations as soon as feasible.
- Patient Prioritization: The process of allocating medical staff to patients based on their level of urgency.
- Ambulance: Ambulances are specially prepared vehicles that take patients to medical institutions such as hospitals or nursing homes.
- Helicopter Depots: These helicopters are specially prepared aircraft that carry injured or sick persons in a medical emergency or over distances/terrain that a typical ground ambulance would find difficult.
- Inventory Management: Monitoring and warning for medical supply shortages.
- Data Security: To avoid data loss, keep data safe and prevent unwanted access.

5. Relevant Facts and Assumptions:

a) Relevant Facts
b) Business Rules
c) Assumptions

6. The Scope of the Work:

a) The Context Diagram
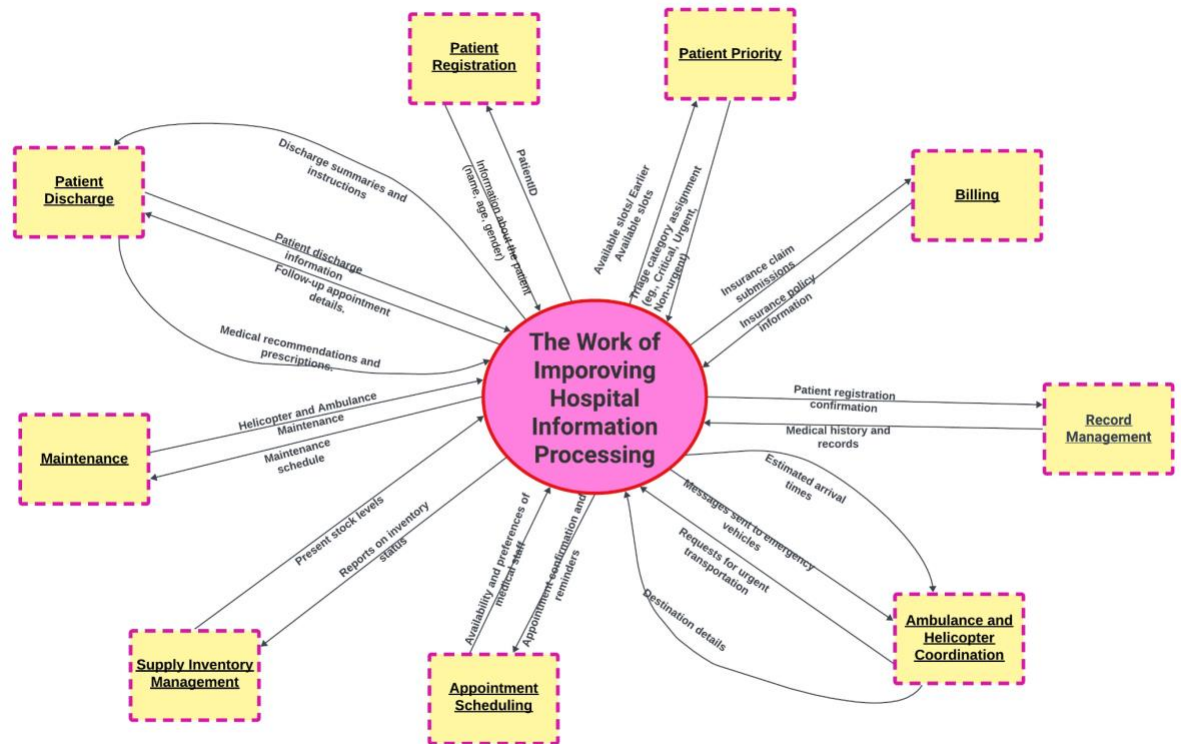
b) Work Partitioning (Business Events and their Inputs and Outputs)

| Business Event	Input	Output
Patient Registration	Information about the patient (name, age, gender)	PatientID
Patient Priority	Triage category assignment (e.g., Critical, Urgent, Non-Urgent)	Available slots/ Earlier Available slots

Billing	Insurance policy information	Insurance claim submissions
Record Management	Medical history and records	Patient registration confirmation
Appointment Scheduling	Availability and preferences of medical staff	Appointment confirmation and reminders
Supply Inventory Management	Present stock levels	Reports on inventory status
Ambulance and Helicopter Coordination	Requests for urgent transportation	Messages sent to emergency vehicles
Ambulance and Helicopter Coordination	Destination details	Estimated arrival times
Maintenance	Helicopter and Ambulance Maintenance	Maintenance schedule
Patient Discharge	Patient discharge information	Discharge summaries and instructions
Patient Discharge	Medical recommendations and prescriptions.	Follow-up appointment details.

c) Specifying Business Use Cases
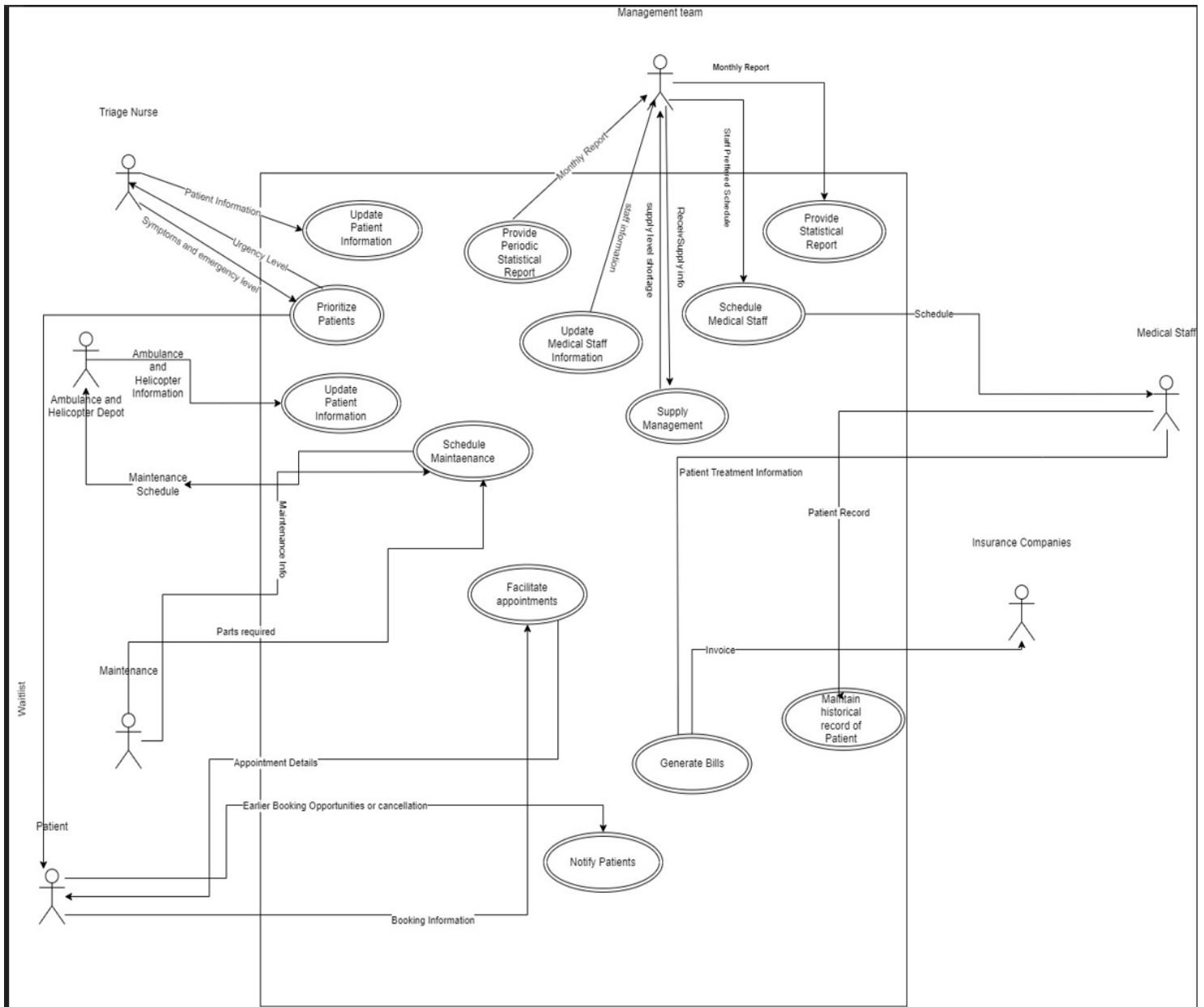
7. The Business Data Model and Data Dictionary:

a) The Data Model
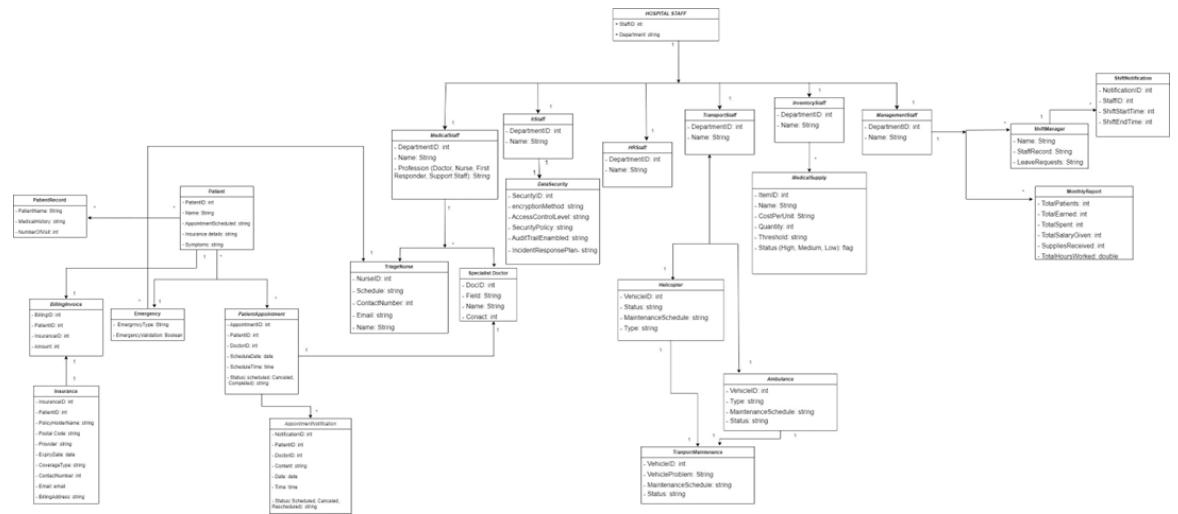
b) Data Dictionary

8. The Scope of the Product

a) Product Use Case Diagram (We have to make this)

b) **Individual Product Use Cases**(14 product use cases diagram we to have make)

1. **Product Use Case Name:** Patient Registers in the Hospital Information System.
   Trigger: Patient is not registered in the Hospital Information System.
   Precondition: The patient must have a need for medical services at Peterborough Hospital, and the patient should not be already registered in the system.
   Interested Stakeholders: Triage Nurse, Hospital Management, IT Staff
   Actor: Patient
   a. The product prompts the patient to access the registration feature on the Hospital Information System.
   b. The product requests the patient to provide essential personal information using a system-generated form.
   c. The patient establishes login credentials for accessing the system.
   d. The product validates the patient's information.
      ● E4.1 If there are errors in the provided information, the product directs the patient to a page highlighting the inaccuracies.
      ● E4.2 The product guides the patient through correcting the errors and prompts re-submission. The system stores patient data securely in the database.
   e. The product's service portal directs the patient to the login page.
   Outcome: The patient's information is recorded in the Hospital Information System, and the patient can now access the hospital's services by logging in with the provided credentials.

2. **Product Use Case Name:** Patient Requests Emergency Triage.
   Trigger: Patient is in need of urgent medical attention.
   Precondition: The patient must have a medical emergency, and the patient should already be registered in the system.
   Interested Stakeholders: Triage Nurse, Emergency Services, Hospital Management
   Actor: Patient
   a. The product alerts the Triage Nurse of the emergency request.
   b. The Triage Nurse accesses the patient's record for initial assessment.
   c. The product prioritizes the patient based on the emergency type.
   d. The Triage Nurse assigns the patient to the appropriate emergency category (e.g., Critical, Urgent).
   e. The product notifies the emergency services for immediate response.
   Outcome: The patient is triaged promptly, and emergency services are dispatched accordingly.

3. **Product Use Case Name:** Patient Updates Medical History
   Trigger: Patient needs to update their medical history.
   Precondition: The patient must be already registered in the Hospital Information System, and there should be changes or additions to their medical history.
   Interested Stakeholders: Triage Nurse, Medical Staff, IT Staff
   Actor: Patient
   a. The product notifies the patient of the need to update their medical history.
   b. The patient accesses the medical history update feature on the Hospital Information System.
   c. The product presents a form with the patient's existing medical history and fields for updates.
   d. The patient submits the updated information.
   e. The product validates the updated medical history.
      - E5.1 If there are discrepancies, the product directs the patient to review and correct the information.
      - E5.2 The product guides the patient through the correction process and stores the updated data securely in the system.
   f. The product confirms the successful update to the patient.
   Outcome: The patient's medical history is accurately updated in the Hospital Information System, ensuring healthcare providers have the latest information for effective treatment.

4. **Product Use Case Name:** Doctor Requests Patient Consultation
   Trigger: Doctor identifies a need for a consultation with a patient.
   Precondition: The doctor must be logged into the Hospital Information System, and the patient should have an existing record.
   Interested Stakeholders: Medical Staff, Triage Nurse, Administrative Staff
   Actor: Doctor
   a. The product allows the doctor to access the patient's record and identifies the need for a consultation.
   b. The doctor initiates a request for a consultation appointment through the system.
   c. The product checks the availability of the patient and schedules the consultation.
      - E3.1 If the patient is unavailable, the product suggests alternative times for the consultation.
      - E3.2 The doctor confirms the consultation appointment.
   d. The product notifies the patient and updates the appointment details in the system.
   Outcome: A consultation appointment is scheduled between the doctor and the patient, facilitating effective communication and medical care.

5. **Product Use Case Name:** Patient Requests Prescription Refill
   Trigger: Patient needs a refill for prescription medication.
   Precondition: The patient must be registered in the Hospital Information System, and there should be an existing prescription.
   Interested Stakeholders: Pharmacist, Patient, Medical Staff
   Actor: Patient
   a. The product notifies the patient that their prescription is due for a refill.
   b. The patient accesses the prescription refill feature on the Hospital Information System.
   c. The product displays the patient's current prescriptions.
   d. The patient selects the prescription to be refilled.
   e. The product verifies the request and sends a notification to the pharmacy.
      - E5.1 If there are issues, the product informs the patient and provides guidance on resolution.
   f. The pharmacy prepares the refill, and the product notifies the patient of its readiness.
   Outcome: The patient successfully requests and receives a prescription refill, ensuring continuity of medication.

6. **Product Use Case Name:** Inventory Staff Updates Supply Levels
   Trigger: Inventory staff identifies low stock levels of medical supplies.
   Precondition: The staff must be logged into the Hospital Information System.
   Interested Stakeholders: Inventory Staff, Hospital Management, IT Staff
   Actor: Inventory Staff
   a. The product alerts the inventory staff of low stock levels.
   b. The staff accesses the inventory management feature on the system.
   c. The product displays a list of supplies with low quantities.
   d. The staff updates the supply levels based on new stock.
   e. The product validates the updated information.
      - E5.1 If discrepancies are found, the product guides the staff through correction.
      - E5.2 The system stores the corrected data securely.
   Outcome: The medical supply inventory is accurately updated, preventing shortages and ensuring smooth healthcare operations.

7. **Product Use Case Name:** Ambulance Coordination for Inter-Hospital Transfer
   Trigger: Patient requires transfer from one hospital to another.
   Precondition: The patient must be registered in the system, and the transfer must be deemed necessary by medical staff.
   Interested Stakeholders: Ambulance Services, Medical Staff, Triage Nurse
   Actor: Triage Nurse
   a. The product alerts the Triage Nurse of the need for inter-hospital transfer.
   b. The nurse accesses the patient's record to determine transfer details.

  c. The product coordinates with ambulance services for the transfer.

  d. The ambulance receives the patient's details and coordinates with the destination hospital.

  e. The product updates the patient's record with transfer information.

Outcome: The patient is successfully transferred between hospitals, ensuring continuity of care.

8. **Product Use Case Name:** Helicopter Coordination for Emergency Response

 Trigger: Patient in a remote area needs urgent medical attention.

 Precondition: The patient must be registered in the system, and the emergency requires helicopter transportation.

 Interested Stakeholders: Helicopter Services, Emergency Services, Triage Nurse

 Actor: Triage Nurse

  a. The product alerts the Triage Nurse of the need for emergency helicopter response.

  b. The nurse assesses the patient's condition and deems helicopter transportation necessary.

  c. The product coordinates with helicopter services for immediate response.

  d. The helicopter receives the patient's details and coordinates with the hospital.

  e. The product updates the patient's record with emergency helicopter transportation information.

 Outcome: The patient receives timely emergency medical transportation via helicopter.

9. **Product Use Case Name:** Patient Discharge and Follow-Up

 Trigger: Patient is ready to be discharged from the hospital.

 Precondition: The patient must have received necessary medical care during their stay.

 Interested Stakeholders: Medical Staff, Administrative Staff, Patient

 Actor: Medical Staff

  a. The product alerts the medical staff that the patient is ready for discharge.

  b. The staff reviews the patient's record and confirms the discharge decision.

  c. The product generates a discharge summary and instructions for the patient.

  d. The staff provides the patient with medical recommendations and prescriptions.

  e. The product updates the patient's record with discharge details.

 Outcome: The patient is successfully discharged, and follow-up instructions are provided for ongoing care.

10. **Product Use Case Name:** Billing and Insurance Claim Submission

 Trigger: Patient receives medical services that require billing and insurance claim submission.

 Precondition: The patient must be registered, and the medical services provided need billing.

 Interested Stakeholders: Billing and Finance Department, Insurance Department, Patient

 Actor: Billing and Finance Department

a. The product alerts the billing department of completed medical services.
b. The billing department accesses the patient's record and generates a billing invoice.
c. The product integrates with insurance information to verify coverage.
d. The billing department submits the insurance claim electronically.
  - E4.1 If there are issues with the claim, the product guides the staff through resolution.
e. The product updates the patient's record with billing and insurance claim details.

Outcome: The billing process is completed, and insurance claims are submitted, ensuring accurate financial transactions.

11. **Product Use Case Name:** Generate Statistical Reports for Hospital Management.
Trigger: Hospital management needs periodic performance reports.
Precondition: The management staff must be logged into the system.
Interested Stakeholders: Hospital Management, IT Staff
Actor: Management Staff
a. The product alerts the management staff of the need for statistical reports.
b. The staff accesses the reporting feature on the system.
c. The product generates statistical reports on hospital performance.
d. The staff reviews and analyzes the reports.
  - E4.1 If discrepancies are found, the product provides options for report customization.
e. The product updates the system with the latest statistical data.

Outcome: Hospital management receives accurate statistical reports, aiding in decision-making and performance assessment.

12. **Product Use Case Name:** Patient Access to Health Records via Secure Portal
Trigger: Patient wants to access their health records.
Precondition: The patient must be registered, and the health records must be securely stored in the system.
Interested Stakeholders: Administrative Staff, IT Staff, Patient
Actor: Patient
a. The product notifies the patient of their ability to access health records.
b. The patient logs into the secure patient portal.
c. The product displays the patient's health records with appropriate access controls.
d. The patient reviews medical information and services received.
e. The product logs the access and updates the patient's record with portal usage details.

Outcome: The patient securely accesses and reviews their health records, promoting transparency and engagement.

13. **Product Use Case Name:** Automated Booking for Specialist Consultation
    Trigger: Patient seeks a consultation with a specialist doctor.
    Precondition: The patient must be registered, and the need for a specialist consultation is identified.
    Interested Stakeholders: Administrative Staff, Specialist Doctors, Patient
    Actor: Administrative Staff
    a. The product alerts the administrative staff of the patient's request for a specialist consultation.
    b. The staff accesses the booking feature on the system.
    c. The product checks the availability of the specialist doctor and schedules the consultation.
    d. The staff notifies the patient of the scheduled specialist consultation.
        - E4.1 If there are scheduling conflicts, the product suggests alternative times.
    e. The product updates the patient's record with the consultation details.
    Outcome: The patient's consultation with a specialist doctor is successfully scheduled, ensuring timely and specialized care.

14. **Product Use Case Name:** Staff Training and Certification Tracking
    Trigger: Staff requires training or certification updates.
    Precondition: The staff member must be logged into the system, and there should be upcoming or expired training/certification.
    Interested Stakeholders: HR Staff, IT Staff, Department Heads
    Actor: HR Staff
    a. The product alerts the HR staff of upcoming or expired staff training/certifications.
    b. The HR staff accesses the training and certification tracking feature on the system.
    c. The product displays a list of staff members with training/certification needs.
    d. The HR staff schedules training sessions and tracks staff progress.
    e. The product updates staff records with training/certification completion details.
    Outcome: Staff training and certification are efficiently managed, ensuring compliance and competency.

9. Functional Requirements:

14 Functional User Stories (One for each Product Use Case).

Requirement #: 1   **Requirement Type: 9**   **Event/BUC/PUC #: 1**

Description: A user-friendly interface to input patient information and symptoms efficiently.

Rationale: Efficient data entry is a necessity for quick patient assessment and giving timely medical attention.

Originator: Triage Nurse

Fit Criterion: The successful input of patient information and symptoms through the user interface.

Customer Satisfaction: 5   **Customer Dissatisfaction:** 2

Dependencies: Well-designed interface for procuring patient information and symptoms.   **Conflicts:** 0

Support Materials: Work Context Diagram, Product Use Case Diagram

History: Created December 04, 2023

Requirement #: 2   **Requirement Type: 9**   **Event/BUC/PUC #: 2**

Description: System must provide an initial patient assessment, including the required medical attention.

Rationale: Having immediate access to an initial assessment aids triage nurses in determining necessary medical interventions promptly.

Originator: Triage Nurse

Fit Criterion: The successful generation of an initial patient assessment based on entered information.

Customer Satisfaction: 4   **Customer Dissatisfaction:** 2

Dependencies: System must incorporate medical guidelines for generating initial patient assessments.   **Conflicts:** 0

Support Materials: Work Context Diagram, Product Use Case Diagram

History: Created December 04, 2023

Requirement #: 3   **Requirement Type: 9**   **Event/BUC/PUC #: 3**

Description: Patients must be prioritized based on medical needs and placed accordingly on a waiting list.

Rationale: Priority based on medical needs ensures timely care for those in critical condition.

Originator: Triage Nurse

Fit Criterion: Successful prioritization of patients and placing them on a waiting list.

Customer Satisfaction: 5   **Customer Dissatisfaction:** 1

Dependencies: System must incorporate a priority algorithm based on medical conditions.   **Conflicts:** 0

Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 4   **Requirement Type: 9**   **Event/BUC/PUC #: 4**
Description: Input scheduling information for medical staff.
Rationale: Efficient scheduling of medical staff is crucial for maintaining optimal healthcare services.
Originator: Hospital Management
Fit Criterion: 95% of healthcare staff schedule information accurately reflected in the scheduling system.
Customer Satisfaction: 2   **Customer Dissatisfaction:** 3
Dependencies: System must have a user-friendly interface for scheduling medical staff.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 5   **Requirement Type: 9**   **Event/BUC/PUC #: 5**
Description: The System should enable the management team to input information regarding healthcare staff, including their preferred working days and times.
Rationale: To facilitate efficient scheduling by allowing the management team to input staff preferences, optimizing resource allocation and improving staff satisfaction.
Originator: Hospital Management
Fit Criterion: 95% of healthcare staff preferences accurately reflected in the scheduling system.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 1
Dependencies: User interface for management input and integration with scheduling algorithms.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 6   **Requirement Type: 9**   **Event/BUC/PUC #: 6**
Description: Ambulance and helicopter depots must be able to input vehicle and helicopter information.
Rationale: Inputting of vehicular information is essential for maintaining an accurate and updated inventory.
Originator: Ambulance and helicopter depots.
Fit Criterion: 80% increase in ambulance and helicopter tracking.
Customer Satisfaction: 3   **Customer Dissatisfaction:** 3
Dependencies: System must have user-friendly interface for entering ambulance and helicopter information.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram

Requirement #: 7   **Requirement Type: 9**   **Event/BUC/PUC #: 7**
Description: System must enable the scheduling of ambulance and helicopter maintenance.
Rationale: Proactive maintenance scheduling ensures the reliability and safety of ambulances and helicopters.
Originator: Ambulance and helicopter depots
Fit Criterion: 85% increase in maintained ambulances and helicopters.
Customer Satisfaction: 1   **Customer Dissatisfaction:** 4
Dependencies: The system should incorporate maintenance scheduling features for vehicular breakdowns and operational disruptions.
Conflicts: 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 8   **Requirement Type: 9**   **Event/BUC/PUC #: 8**
Description: The system must maintain historical records of patients, the medical services received, and the dates and times of visits.
Rationale: Maintaining a comprehensive patient record is vital for providing continuity of care and historical reference.
Originator: Administrative Staff
Fit Criterion: 90% increase in successful storage and retrieval of patient records, including medical services and visit details.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 2
Dependencies: System must have a secure and scalable database for storing the patient records.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 9   **Requirement Type: 9**   **Event/BUC/PUC #: 9**
Description: The System must monitor medical supply levels and alert management of any shortages.
Rationale: To prevent disruptions in medical services due to supply shortages.
Originator: Hospital Inventory Management
Fit Criterion: Real-time monitoring with instant notifications for critical supply levels.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: Integration with the inventory tracking module.
Conflicts: 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 10   **Requirement Type: 9**   **Event/BUC/PUC #: 10**

Description: The system must provide statistical reports to managers on a periodic basis.

Rationale: Periodic statistical reports will aid management in assessing performance and making informed decisions.

Originator: Hospital Management

Fit Criterion: 95% increase in performance.

Customer Satisfaction: 4   **Customer Dissatisfaction:** 1

Dependencies: The System must have tools for reporting the generated statistical reports.   **Conflicts:** 0

Support Materials: Work Context Diagram, Product Use Case Diagram

History: Created December 04, 2023

Requirement #: 11   **Requirement Type: 9**   **Event/BUC/PUC #: 11**

Description: The System must generate billing information for insurance companies based on the level of care administered to patients.

Rationale: To automate the billing process, ensuring accurate and timely reimbursement.

Originator: Billing and Finance Department

Fit Criterion: Billing information accuracy within 2% deviation.

Customer Satisfaction: 4   **Customer Dissatisfaction:** 1

Dependencies: Integration with the patient care recording module.

Conflicts: 0

Support Materials: Work Context Diagram, Product Use Case Diagram

History: Created December 04, 2023

Requirement #: 12   **Requirement Type: 9**   **Event/BUC/PUC #: 12**

Description: Patients must be given limited access to health-related information and record of services.

Rationale: Providing patients with access to their health information will promote transparency and patient engagement.

Originator: Administrative Staff

Fit Criterion: 100% secure and user-friendly patient portal for them to access their health information.

Customer Satisfaction: 5   **Customer Dissatisfaction:** 3

Dependencies: The System must have secure patient portal features for them to access health records.   **Conflicts:** 0

Support Materials: Work Context Diagram, Product Use Case Diagram

History: Created December 04, 2023

Requirement #: 13   **Requirement Type: 9**   **Event/BUC/PUC #: 13**
Description: The System should automate the booking process for patients seeking consultations with specialist doctors.
Rationale: To streamline the appointment booking process, reducing administrative workload and enhancing patient experience.
Originator: Administrative Staff
Fit Criterion: 90% reduction in manual booking efforts.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: Integration with the specialist doctor's availability module.
Conflicts: 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

Requirement #: 14   **Requirement Type: 9**   **Event/BUC/PUC #: 14**
Description: The System should notify patients of earlier appointment booking opportunities or cancellations.
Rationale: To enhance appointment management and patient satisfaction, patients must be notified of any booking opportunities or cancellations well before.
Originator: Administrative Staff
Fit Criterion: 85% increase in real-time appointment booking updates.
Customer Satisfaction: 3   **Customer Dissatisfaction:** 2
Dependencies: The System must have a notification mechanism for alerting patients of booking opportunities or cancellations.
Conflicts: 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

10. Non-functional Requirements:

12 Non-functional User Stories.

User Story #: 1
Description: The product should be easy to use.
Rationale: To enhance user satisfaction and minimize the learning curve for all system users.
Originator: User Experience (UX) Team
Fit Criterion: 90% positive feedback in usability testing.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 2
Dependencies: Continuous feedback loop with end-users for usability improvements.
Conflicts: 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 2
Description: The product should be easy to learn.
Rationale: To ensure quick adaptation by users, minimizing training time and resources.
Originator: Training and Development Team
Fit Criterion: 80% of users should complete basic training within one hour.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: User training materials and interactive learning modules.
Conflicts: 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 3
Description: The product should ensure the security and integrity of data.
Rationale: To safeguard sensitive patient information and maintain data accuracy.
Originator: IT Security Department
Fit Criterion: Implementation of encryption protocols and regular data integrity checks.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 1
Dependencies: Integration with robust security infrastructure and regular security audits.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 4

Description: The product should ensure the privacy of users.
Rationale: To comply with privacy regulations and instill trust in users regarding the confidentiality of their information.
Originator: Legal and Compliance Team
Fit Criterion: Adherence to data protection laws and policies.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 1
Dependencies: Legal and compliance frameworks, privacy policy implementation.
Conflicts: 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 5
Description: The product interface should be compliant with the branding standards of Peterborough Hospital.
Rationale: To maintain a consistent and professional appearance in alignment with the hospital's brand identity and specific requirements for healthcare applications.
Originator: Branding and Design Team
Fit Criterion: Adherence to Peterborough Hospital's branding guidelines for healthcare applications in all interface elements.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 2
Dependencies: Access to and understanding of Peterborough Hospital's branding guidelines.   **Conflicts:** 1
Support Materials: Work Context Diagram, Product Use Case Diagram
Individual Product Use Cases: Interface Design Compliance
History: Created December 04, 2023

User Story #: 6
Description: The product should be available in both English and French.
Rationale: Offering the product in multiple languages ensures inclusivity and accessibility for a diverse user base.
Originator: End User
Fit Criterion: Users should be able to switch between English and French language options seamlessly.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: The development team should implement language localization features.   **Conflicts:** 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 7
Description: The product should be accessible 24 hours a day.

Rationale: Continuous availability ensures users can access the product whenever needed.
Originator: End User
Fit Criterion: The product should be accessible at all times, with minimal downtime for maintenance.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 1
Dependencies: The development and maintenance teams should implement robust infrastructure and minimize maintenance windows.
Conflicts: 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 8
Description: The product should be fault-tolerant.
Rationale: Fault tolerance ensures uninterrupted service even during network congestion or overload.
Originator: System Administrator
Fit Criterion: The product should maintain functionality even under high network loads or temporary outages.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: The development team should implement load balancing and resilience mechanisms.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 9
Description: The product should require a maximum of 2 hours of maintenance every 3 months.
Rationale: Minimal maintenance windows ensure continuous service availability and optimal system performance.
Originator: System Administrator
Fit Criterion: Scheduled maintenance should be completed within a 2-hour window, and there should be no unplanned downtimes.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 1
Dependencies: The development and maintenance teams should implement efficient maintenance procedures.   **Conflicts:** 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 10
Description: The product should be available to run on all available browsers.

Rationale: Browser compatibility ensures users can access the product using their preferred web browsers.
Originator: End User
Fit Criterion: The product should be accessible and fully functional across popular web browsers.
Customer Satisfaction: 5   **Customer Dissatisfaction:** 1
Dependencies: The development team should conduct thorough testing on various browsers and devices.   **Conflicts:** 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 11
Description: The product should ensure that only authorized personnel can access the system.
Rationale: Access control measures are essential for protecting sensitive data and maintaining regulatory compliance.
Originator: Security Officer
Fit Criterion: The product should implement role-based access controls, authentication, and authorization mechanisms.
Customer Satisfaction: 4   **Customer Dissatisfaction:** 2
Dependencies: The development team should implement and manage role-based access controls.   **Conflicts:** 0
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

User Story #: 12
Description: The product should allow auditors to audit the accounting data.
Rationale: Auditing capabilities are crucial for regulatory compliance and accountability.
Originator: Auditor
Fit Criterion: The product should provide comprehensive audit logs and tools for auditing accounting data.
Customer Satisfaction: 3   **Customer Dissatisfaction:** 2
Dependencies: The development team should implement auditing mechanisms in the accounting module.   **Conflicts:** 1
Support Materials: Work Context Diagram, Product Use Case Diagram
History: Created December 04, 2023

11.   Project Issues:

a) Risks

In Terms of risk assessment there are several risks which come into play. The major risks regarding this project are mentioned below:

● Technical Risk: This type of risk comes into play when there are software bugs, hardware failures, compatibility issues and many more which disturb the project growth. This type of risk can lead to delays and disconnection of the main server, and they can cost a lot of money to fix. These can be resolved by doing technical assessments and having contingency plans in place to address this type of risk.

● Resource Constraints: Budget restrictions or a lack of resources could prevent the proper distribution of resources, such as qualified staff, hardware, and software. Resource limitations may cause project milestones to be missed and lower the HIS's overall quality. Create a detailed plan for allocating resources, give priority to those that are most important, and periodically evaluate and modify the plan based on the demands of the project.

● Challenge Resistance: The new HIS may be difficult for hospital employees, especially medical professionals, to adapt to because of changes to workflows or reluctance to learn a new system. Change-averseness can hinder the HIS's adoption and reduce the effectiveness of healthcare operations. Implement a thorough change management plan that involves stakeholder involvement in decision-making through communication, training, and involvement.

● Data security Breaches: Patient privacy may be jeopardized, and data protection regulations may be broken because of inadequate data security. Data breaches may lead to monetary fines and legal repercussions, harm to the hospital's reputation, and erosion of patient confidence. Implement strong access controls, encryption, and frequent security audits as mitigation measures. Ensure that all data protection laws are followed.

● Timeline Delays: The project's ability to achieve the operational date may be impacted by unanticipated problems or difficulties that delay project milestones. Hospital operations might be hampered by schedule delays, which also raise project costs. Create a comprehensive project schedule that includes time reserves for unforeseen delays. Stay on course by keeping an eye on your progress and acting appropriately.

● Scope Creep: The project's ability to achieve the operational date may be impacted by unanticipated problems or difficulties that delay project milestones. Hospital operations might be hampered by schedule delays, which also raise project costs. Create a comprehensive project schedule that includes time reserves for unforeseen delays. Stay on course by keeping an eye on your

progress and acting appropriately. Regular risk evaluations and proactive risk management will help to reduce these risks and enable the effective development and implementation of the HIS while abiding by budget and timeframe restrictions.

b) Cost Assessment

Counting Function Points:

1. Input Business Use Cases:

Class Referenced	Data attributes		
	1-4	5-15	16+
<2	3	3	4
2	3	4	6
>2	4	6	6

Business Use Case	Classes	Attributes	Function Point
Patient record is entered into the system, and it is a not an emergency.	Patient, PatientAppointment, Specialist Doctor **Total:** 3 classes	PatientID, PatientName, AppointmentID, ScheduleDate, ScheduledTime,Status DoctorID, DoctorName and maybe 2 more **Total:** 10 attributes	6
Triage Nurse enters patient record into the system because it's an emergency case.	Patient, TriageNurse, Emergency **Total:** 3 classes	PatientID, PatientName, Age, Address, ContactInfo, NurseId, NurseName, EmergencyType and maybe 2 more **Total:** 10 attributes	6

Shift manager inputs scheduling information for medical staff	ManagementStaff, ShiftManager, ShiftNotification **Total:** 3	DepartmentId, Name, LeaveRequests, NotificationID, StaffID, Date, ShiftStartTime, ShiftEndTime and maybe 2 more **Total:** 10	6
Inventory Staff requests medical supplies	InventoryStaff, Medical supply **Total:** 2	DepartmentID, Name, ItemID, ItemName, QuantityStatus, ItemThreshold **Total:** 6	4
Transport Maintenance request from Transport Staff	TransportStaff, Ambulance, Helicopter, TransportMaintenanceStaff **Total: 4**	DeptId, Name, VehicleId, Type, MaintenanceSchedule, VehicleProblem **Total: 6**	6
Specialist Doctor updates the patient Record	Specialist Doctor, Patient, PatientRecord **Total: 3**	DocID,Doctorname, field, contact, PatientID, Name, Address, MedicalHistory and maybe 2 more **Total: 10**	6

2. Counting Internally Stored Data:

Class Referenced	Attributes		
	1-19	20-50	51+
<2	7	7	10
2-5	7	10	15
>5	10	15	15

Business Use Case	Classes	Attributes	Function Point
Storing Hospital Staff information.	Hospital Staff, MedicalStaff, ITStaff, HrStaff, TransportStaff, InventoryStaff, ManagementStaff **Total: 7**	StaffID, DeptID, Name, Contactinfo, Address,EmergencyContact, Schedule and maybe two more **Total: 9**	10
IT Staff makes a data security dashboard.	ITStaff, DataSecurtiy **Total: 2**	DeptID, EncryptionMethod, SecurityPolicy, AccessControlLevel and maybe 2 more **Total: 6**	7

3. Output Business Use Cases:

Class Referenced	Data attributes		
	1-5	6-19	20+
<2	4	4	5
2-3	4	5	7
>3	5	7	7

Business Use Case	Classes	Attributes	Function Point
Patient gets appointment notification.	Patient, PatientAppointment, AppointmentNotification **Total: 3**	patientId, patientName, appointmentId, doctorName, scheduledDate, scheduledTime, status and maybe 2 more **Total: 9**	5
Hospital Staff gets their shift notification.	HospitalStaff, ManagementStaff, ShiftManager, ShiftNotification **Total: 4**	StaffID, StaffName, StaffRecord, LeaveRequest, date, ShiftStartTime, ShiftEndTime **Total: 7**	7
Alert ambulance depot of patient transportation.	Patient, TransportStaff, Ambulance **Total: 3**	PatientID, PatientName, DeptID, VehicleID, VehicleType and maybe 2 more **Total: 7**	5
Alert helicopter depot of patient transportation.	Patient, TransportStaff, Helicopter **Total: 3**	PatientID, PatientName, DeptID, VehicleID, VehicleType and maybe 2 more **Total: 7**	5

| Generate billing information for insurance companies. | PatientRecord, Patient, BillingInvoice, Insurance.
Total: 3 | PatientID, Patient Name, MedicalHistory, NumberofVisits, BillingInvoice, InsuranceID, Amount, PolicyHolderName, Provider, ExpiryDate, CoverageType, ContactNumber, Email, BillingAddress
Total: 14 | 5 |

4. Time triggered Business Use Cases:

Class Referenced	Data attributes of input flow		
	1-5	6-19	20+
1	3	3	4
2-3	3	4	6
>3	4	6	6

Business Use Case	Classes	Attributes	Function Point
Management provides a monthly Report.	ManagementStaff, MonthlyReport **Total: 2**	DeptId, Name, TotalPatients, TotalEarned, TotalSpent, TotalSalaryGiven, SuppliesReceived and maybe 2 more **Total: 9**	4

Total Function Points = 82

Effort in staff months = (Function points/150) * (function points) ^0.4

Effort in staff months = $(82/150) * (82)^{0.4} = 3.18$