

Software Requirements Specifications

Assessment 1A – Version 1.0

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GROUP C

Amelia Clancy (claay034)

Wayne Crews (crewy002)

Dak Doyle (doydy008)

Caitlin Keen (keecy010)

Jennifer Nguyen (ngujy064)

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# 1. Business Requirements

## 1.1 Executive Summary

The "Let's Mine Chess! A Testbed for Pattern Mining" project addresses the challenge of analysing incomplete healthcare datasets by developing a robust pattern mining framework using chess data. Healthcare analytics often struggle with incomplete datasets, leading to either small, non-representative samples or untrustworthy analyses. By leveraging the completeness and abundance of publicly available chess data, this project simulates and addresses these challenges, creating a transferable framework applicable to healthcare data.

The project aims to innovate in data analysis by developing a pattern mining framework capable of handling incomplete datasets without compromising robustness or accuracy. Using the KNIME open-source data analytics platform ensures scalability and accessibility. Key objectives include validating the framework with chess data, achieving at least 90% pattern recognition accuracy with up to 20% data incompleteness, and transitioning these methods to healthcare data.

Expected outcomes include enhancing decision-making processes in healthcare analytics by providing a reliable method to analyse incomplete datasets and contributing to academic research by addressing gaps in current methodologies concerning data incompleteness. Deliverables include a comprehensive data analysis pipeline, detailed documentation, and a final report with recommendations for healthcare applications.

The project team, consisting of Amelia Clancy, Wayne Crews, Dak Doyle, Caitlin Keen, and Jennifer Nguyen, will follow a structured timeline with specific milestones and a budget of $130,000. Identified risks include data quality, tool limitations, and resource availability, with mitigation strategies in place. The project will conclude upon validation of the framework with acceptable accuracy and approval from project sponsors Georg Grossmann and Jan Stanek.

## 1.2 Project Purpose/ Justification

The purpose of this project is to develop a robust pattern mining framework using chess data a a surrogate for healthcare data, addressing the challenges associated with incomplete datasets. This section will outline the business need for this project and its objectives, detailing how it aims to enhance data analysis capabilities and contribue to both academic research and practical applications.

### 1.2.1 Business Need/Case

The primary business need for this project arises from the inherent difficulties in analysing healthcare data, which are often incomplete. This poses two main problems, either the records with incomplete data are removed entirely leaving a small dataset that is incapable of providing robust results, or if incomplete records are included in the analysis, there is a problem with trustworthiness of results as there is no framework to test the impact of the missing datapoints.

These challenges necessitate a solution that can handle incomplete datasets effectively while maintaining robust data analysis capabilities. The project aims to develop a pattern mining framework using chess data as a surrogate for healthcare data. Chess data is both abundant and publicly available, and complete, allowing us to bypass many of the restrictions associated with healthcare data. By leveraging chess data, we can simulate and address the issues of data incompleteness and test the robustness of our methods before applying them to more sensitive healthcare data. The intended effects of this project include cost savings, process improvements, and the development of new techniques for data analysis that can be transitioned to healthcare applications. This project also aims to fill the gap in existing literature and methodologies concerning the robustness of pattern recognition algorithms when faced with incomplete data, thus contributing to both academic research and practical applications in not only healthcare, but in other domains where there are issues with incompleteness in sequential datasets.

### 1.2.2 Business Objectives

The key business objectives for this project are as follows:

1. Develop a domain-independent pattern mining framework.
2. Ensure the robustness of the developed methods in dealing with incomplete datasets.
3. Facilitate the transition of these methods from chess data to healthcare data, thereby improving decision-making processes in healthcare analytics.
4. Validate the framework using publicly available chess data, ensuring that the methods can identify known patterns and withstand the impact of missing data.
5. Create a scalable and reusable data analysis pipeline that can be used for the healthcare domain in the first instance, but can be applied in other domains in the future.

## 1.3 Project Description

The project, "Let's Mine Chess! A Testbed for Pattern Mining," aims to develop a robust pattern mining framework using chess data to simulate challenges faced in healthcare data analysis. Pattern mining is crucial for decision-making, especially in healthcare, where early detection of harmful outcomes can lead to timely interventions. However, existing techniques often require perfect datasets, which is rarely the case in real-world scenarios. By using chess game data, which is abundant and can be linked to outcomes like openings and game results, the project will test and refine pattern mining methods that can handle incomplete datasets. The goal is to implement this framework in KNIME, an open-source platform, ensuring it can identify patterns even with missing data.

### 1.3.1 Project Objectives and Success Criteria

There are three primary objectives: to familiarise with the chess dataset and the KNIME platform, importing and preparing data, and applying initial process mining algorithms within the first 4 weeks; to link identified patterns to outcomes by translating chess openings into recognisable patterns by the 8th week; and to test the framework's robustness by incrementally removing data to assess if patterns remain detectable, to be completed by the 16th week. Success will be measured by successful data import and preparation in KNIME, with basic pattern recognition algorithms applied; accurate mapping of chess openings to identifiable patterns with at least 90% accuracy; and demonstrating that the framework can detect patterns even with up to 20% data incompleteness without significant loss of accuracy.

### 1.3.2 Requirements

The project requires access to large, publicly available chess datasets, such as those from chess.com or lichess.org, and tools for data mining and analysis, specifically the KNIME platform. Additionally, a comprehensive library of chess openings is necessary to validate pattern recognition. The project also requires the capability to simulate data incompleteness to test the robustness of the data mining methods.

### 1.3.3 Constraints

Constraints include the use of open-source and freely available tools to ensure accessibility and reproducibility, a project timeframe of 20 weeks split into two 10-week phases with a break in between, and team members working full-time alongside the project, which may limit their availability. The initial focus will be on chess data, with the possibility of applying the findings to healthcare data at a later stage.

### 1.3.4 Assumptions

It is assumed that the chess datasets used are complete, accurate, and representative of typical chess games. It is also assumed that the data mining techniques applied to chess data will be transferable to healthcare data analysis and that KNIME will support all required data processing and analysis tasks. Furthermore, it is assumed that stakeholders will provide timely feedback and necessary resources to support the project.

### 1.3.5 Preliminary Scope Statement

This project aims to build a robust pattern mining framework using chess data to address challenges in analysing incomplete healthcare datasets. The framework will identify chess openings and assess the impact of data incompleteness on pattern recognition. Initial efforts will focus on setting up the analysis pipeline and validating it with chess data. Upon validation, the methods will be applied to healthcare datasets. The project will be considered complete upon the successful creation of a reusable data analysis pipeline, validated through its application to both chess and healthcare data.

## 1.4 Risks

All projects have inherent risks, and this project is no exception. Several high-level risks have been identified that could potentially impact its success:

1. **Data Quality and Availability:** While chess data is extensive and publicly available, it may contain inconsistencies or errors, impacting the accuracy of the pattern mining process. Ensuring high-quality, complete data is crucial for reliable outcomes.

**Management Plan:** Implement data validation and cleaning procedures, regularly review and correct data.

1. **Tool Limitations and Compatibility:** The reliance on the KNIME platform for data mining and analysis also presents a risk. KNIME may not fully support all required functionalities or may have compatibility issues with the datasets or additional tools, potentially limiting the effectiveness of the analysis and necessitating troubleshooting or alternative solutions.

**Management Plan:** Assess KNIME’s capabilities early, integrate supplementary tools, and develop contingency plans.

1. **Data Incompleteness Simulation:** The methods used may not accurately reflect real-world scenarios, skewing results and leading to incorrect conclusions about the robustness of the data mining framework.

**Management Plan:** Use multiple simulation techniques, validate against known scenarios, and refine methods continuously.

1. **Resource Availability:** The project team members are working full-time alongside this project, which may limit their availability and ability to meet project deadlines, potentially causing delays in milestone achievements and project completion.

**Management Plan:** Create a realistic timeline with buffers, assign clear roles, and monitor progress closely.

1. **Stakeholder Engagement:** There is a risk that stakeholders may not be available as needed, leading to delays in decision-making and misalignment with project goals.

**Management Plan:** Establish regular communication channels and schedules, ensure continuous engagement, and provide timely updates.

1. **Technical Challenges:** Developing a robust pattern mining framework involves complex tasks like data preprocessing, algorithm development, and validation. Unforeseen technical issues may arise, requiring additional time and resources to resolve.

**Management Plan:** Allocate extra time for problem-solving, leverage team expertise, and maintain flexibility in the project plan.

1. **Applicability to Diverse Datasets:** The methods and framework developed for chess data may need adjustments to be applicable to healthcare data or other datasets due to differences in data structure, quality, and complexity. This adaptability is crucial for the project's overall impact and relevance.  
   **Management Plan:** Conduct preliminary analysis on various datasets, adjust methods as needed, and consult domain experts to ensure the framework's versatility.
2. **Security and Privacy Concerns:** Future applications involving healthcare or other sensitive data must address security and privacy concerns. Inadequate measures to protect sensitive information could lead to compliance issues and damage the project's credibility.  
   **Management Plan:** Implement robust security and privacy protocols, ensure compliance with regulations, and regularly audit security measures.

By identifying, assessing, and planning for these risks, the project team can mitigate potential issues, ensuring the successful completion of the project and the achievement of its objectives.

## 1.5 Project Deliverables

The project deliverables are critical to its success and include the following:

* **Comprehensive Chess Datasets:** Obtain and prepare an extensive dataset from platforms like lichess.com. These datasets will serve as the foundation for developing and testing the pattern mining framework.
* **Pattern Mining Framework in KNIME**: Implement the pattern mining framework using KNIME, an open-source data analytics platform. This framework will be designed to handle large datasets and perform robust pattern recognition even with incomplete data.
* **Detailed Documentation:** Produce thorough documentation covering the methods, algorithms, and the entire data pipeline. This will include user manuals, technical specifications, and guidelines for future enhancements.
* **Final Report and Presentation**: Compile a final report summarising the project's findings, methodologies, and results. Additionally, prepare a comprehensive presentation to communicate the project's outcomes to stakeholders.
* **Reusable Data Analysis Pipeline:** Develop a scalable and reusable data analysis pipeline that can be validated with both chess and healthcare data. This pipeline will ensure that the methods are adaptable to various datasets and domains.
* **Recommendations for Healthcare Applications:** Provide a set of recommendations for applying the developed framework to healthcare data. This will include best practices for handling incomplete data and ensuring the robustness of pattern recognition algorithms.

## 1.6 Summary Milestone Schedule

The project will follow a structured timeline with high-level milestones to ensure systematic progress:

1. **Week 1-2: Data Collection and Preparation**
   * Tasks: Collect and prepare chess data from recommended sources. This involves cleaning the data to ensure it is ready for analysis.
   * Deliverables: A cleaned and prepared dataset suitable for pattern mining.
2. **Week 3-4: Initial Pattern Mining**
   * Tasks: Apply initial pattern mining algorithms in KNIME. Validate the results by comparing them with known chess openings to ensure accuracy.
   * Deliverables: Initial results from pattern mining algorithms.
3. **Week 5-6: Testing with Incomplete Data**
   * Tasks: Simulate data incompleteness by removing portions of the dataset randomly. Test the robustness of the pattern mining methods under these conditions.
   * Deliverables: A report analysing the impact of missing data on pattern recognition accuracy.
4. **Week 7-8: Final Report and Presentation**
   * Tasks: Compile the findings into a comprehensive report. Prepare and deliver a final presentation to stakeholders, summarising the methodologies and outcomes.
   * Deliverables: Final project report and presentation materials.

## 1.7 Summary Budget

|  |  |  |
| --- | --- | --- |
| **Item** | **Description** | **Cost** |
| **AWS KNIME Server** | Deployment of KNIME Server Medium on AWS for 12 months *(Pricing Estimate included in Appendix A)* | $50,000 |
| **Personnel** | Project team working 75 hours per week for 20 weeks at $50/hour | $50/hour \* 75 hours/week \* 20 weeks = $75,000 |
| **Data Acquisition** | Publicly available chess data | Free |
| **Software and Tools** | KNIME Analytics Platform (open‑source) | Free |
| **Miscellaneous Costs** | Contingency for incidentals | $5,000 |
| **Total Estimated Cost** |  | $130,000 |
| **Budget Notes**  This budget covers the potenital to deploy the pipeline on a KNIME server for 12 months as requested by the stakeholders. After investigation of the options for this, deploying on AWS Infrastructure was the most cost effective and flexible approach vs. installing on premisis hardware.  Personnel has been given an hourly rate for the esitmated hours of the students. While the project team will not be paid on this project, this is an estimate to give the stakeholders an idea of the cost if they were to employ paid personnel to complete the project.  The KNIME software and other tools are either open source or the project team already has access to.  The data is publicaly availble and free.  A budget line for Miscilaneous costs has been included in the case that the project team requires to puchase things like GPU time on Google Collab to run the algorithims, or testing on an AWS e2 instance to show proof of concept for the deployment. | | |

## 1.8 Project Approval Requirements

Successful completion of all milestones, validation of the pattern mining framework with acceptable accuracy, and approval from project sponsors (Georg Grossmann and Jan Stanek) will constitute the criteria for project approval.

### 1.8.1 Criteria for Project Approval

**Milestone Completion:** Ensure all project milestones are completed as per the project plan.

**Framework Validation:** The pattern mining framework must demonstrate acceptable accuracy and robustness, especially in handling incomplete data.

**Sponsor Approval:** Obtain formal approval from the project sponsors, Georg Grossmann and Jan Stanek, signifying that the project meets all specified requirements and quality standards.

## 1.9 Project Management

This section outlines the responsibilities and authority of the Project Manager (PM), Dak Doyle. Depending on the organization and scope of the project, the PM may have varying levels of responsibility and authority for personnel, project expenditures, and scheduling.

### 1.9.1 Project Manager Responsibilities

**Role:** Dak Doyle, Project Manager/Scrum Master

Responsibilities

**Chairing Meetings:** Dak will chair all project meetings, including sprint reviews, sprint retrospectives, and regular stand-ups, ensuring they are productive and on schedule.

**Sprint Planning and Execution:** Responsible for planning and executing sprints, including defining sprint goals, estimating story points, and assigning tasks to team members.

**Team Assistance:** Assist team members with any queries or obstacles they encounter, facilitating a smooth workflow and promoting team collaboration.

**Progress Tracking:** Monitor project progress using Jira and other project management tools, ensuring that tasks are completed on time and within scope.

**Communication:** Maintain clear and effective communication with stakeholders, including regular updates and reports on project status.

**Resource Management:** Manage project resources, including personnel, budget, and time, to ensure efficient utilisation and project success.

**Risk Management:** Identify potential risks and develop mitigation strategies to minimise their impact on the project.

**Quality Assurance:** Ensure that all project deliverables meet the required quality standards and specifications.

**Documentation:** Oversee the creation and maintenance of project documentation, including the requirements document, design documents, and final reports.

**Project Closeout:** Ensure all project deliverables are completed, approved by stakeholders, and that the project is formally closed out.

### 1.9.2 Project Management Plan

The project management plan is centered around four sprints, each aligned with the project's milestones. This plan ensures that the project progresses methodically, with regular assessments and adjustments to stay on track.

|  |  |  |  |
| --- | --- | --- | --- |
| **Objectives** | **Tasks** | **Deliverables** | **Meetings** |
| **Sprint 1:** Getting Familiar with Data and the Open-Source Platform (Weeks 1-2) | | | |
| Import and prepare data into KNIME.  Apply initial process mining algorithms. | Data collection and cleaning.  Setup of KNIME environment.  Initial algorithm testing and validation. | Cleaned and prepared dataset.  Initial process mining results. | Kick-off meeting with stakeholders.  Weekly stand-ups.  Sprint review and retrospective. |
| **Sprint 2:** Linking Patterns to Outcomes (Weeks 3-4) | | | |
| Translate and map chess openings into patterns. | Pattern identification.  Mapping chess openings to detected patterns.  Validation of identified patterns. | Documented patterns and mappings.  Validation report on pattern accuracy. | Weekly stand-ups.  Sprint review and retrospective. |
| **Sprint 3:** Testing on Incomplete Data (Weeks 5-6) | | | |
| Gradually remove data from the dataset and test if patterns are still detectable. | Simulate incomplete datasets.  Test pattern mining algorithms on incomplete data.  Analyse results and determine robustness. | Report on algorithm performance with incomplete data. | Weekly stand-ups.  Sprint review and retrospective. |
| **Sprint 4:** Report and Final Presentation (Weeks 7-8) | | | |
| Write an experience and summary report with results. | Compile findings from all sprints.  Write and review the final report.  Prepare the final presentation. | Final experience and summary report.  Final presentation to stakeholders. | Weekly stand-ups.  Sprint review and retrospective.  Final presentation meeting. |

**Tools and Resources**

**Jira:** For task management, sprint planning, and tracking progress.

**GitHub:** For code repository and version control, facilitating code reviews and collaboration.

**KNIME:** For data preparation and process mining.

**Risk Management**

Identify and assess potential risks at the beginning of each sprint.

Develop mitigation strategies and assign responsibility for managing risks.

Monitor and review risks regularly during stand-ups and sprint reviews.

**Quality Assurance**

Establish quality standards and criteria for deliverables.

Conduct regular reviews and testing to ensure compliance with quality standards.

Document and address any issues or defects promptly.

**Communication Plan**

Maintain open and transparent communication with all team members and stakeholders, via teams, and email.

Schedule regular updates and reports to keep everyone informed of progress and any issues.

Use the Teams channel for ongoing communication and collaboration.

## 1.10 Authorisation

This document will be sent to the Project Sponsor and the team will update the assessors once approved.

Approved by the Project Sponsor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: / /

Project Sponsor Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Project Sponsor Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# 2. System Requirements

## 2.1 Use Case Analysis

### 2.1.1 Triage Use Case

1. Use case Number 1

Complete a triage booking form.

A diagram of a doctor consulting

Description automatically generated

2. Use case name and description

The automated system in this use case will use the algorithm from the Chess pattern mining framework. A patient attends a hospital triage and completes an automated triage booking form that captures their personal information and their symptoms. The automated system will respond with a case number and instructions to proceed to a designated area within the hospital.

3. Actors

* Patients.
* Nurses.
* Doctors.

4. Stakeholders

* Hospital employees e.g. management, administration, and medical staff.
* Hospital board of directors.
* Pharmaceutical and medical supply companies.
* Governments and their respective health departments.
* Medicare.
* Health and other insurance companies.
* Donors to the hospital.

5. Primary actor

Patient who is feeling unwell and goes to the hospital triage for medical attention.

6. Preconditions

Patient is feeling unwell and attends a hospital triage to seek medical assistance. The hospital triage must have a system for registering patients and have the necessary staff available to assist and treat the patient.

7. Triggers

Patient enters their personal information and symptoms into an automated booking system.

8. Basic flow

* Patient arrives at the hospital triage and proceeds to the triage automated booking station.
* Patient enters their personal information and Medicare number.
* Patient enters their symptoms into the system e.g. breathing problems, chest pain, broken bone etc.
* The system determines if the medical issue is a major or a minor case.
* If it is a major case, patient is instructed to go to a certain area within the hospital for an immediate consultation with a doctor.
* If it is a minor case, the patient must complete further questions in the automated booking form to facilitate further screening of their medical condition.
* Following this further screening, the system will categorise the patient’s minor case with either a red, amber, or green flag.
* Patients with red or amber flag cases will be instructed to go to a certain area within the hospital for a consultation with a doctor.
* Patients with green flag cases will be instructed to go to a certain area within the hospital for a consultation with a nurse.

9. Alternative path

* Patient arrives at the hospital triage and proceeds to the triage automated booking station.
* The automated booking station is not working.
* Patient completes manual booking form with personal details and Medicare number.
* Patient has consultation with triage nurse who determines if the medical issue is a major or a minor case.
* If it is a major case, patient is instructed to go to a certain area within the hospital for an immediate consultation with a doctor.
* If it is a minor case, the patient has a consultation with a nurse for further screening and their case is categorised with either a red, amber, or green flag.
* Patients with red or amber flag cases will be instructed to go to a certain area within the hospital for a consultation with a doctor.
* Patients with green flag cases will be instructed to go to a certain area within the hospital for a consultation with a nurse.

### 2.1.2 Hospital Bed Booking Use Case

1. Use case Number 2

Complete hospital bed booking form.

A diagram of a bed

Description automatically generated

2. Use case name and description

The automated system in this use case will use the algorithm from the Chess pattern mining framework. A hospital staff member completes a hospital bed booking form for a patient. The automated system will respond with a bed number within a designated area in the hospital.

3. Actors

* Hospital administrative staff.

4. Stakeholders

* Patients.
* Hospital employees e.g. Nurses, doctors, management, other medical staff.
* Hospital board of directors.
* Pharmaceutical and medical supply companies.
* Governments and their respective health departments.
* Medicare.
* Health and other insurance companies.
* Donors to the hospital.

5. Primary actor

Hospital administrative staff member who is booking a hospital bed for a patient.

6. Preconditions

Patient has a medical condition and needs to spend some time in hospital to have some procedures completed. The hospital must have a system for booking a bed and have beds available for patients.

7. Triggers

Hospital administrative staff enters the patient’s personal information and symptoms into an automated bed booking system.

8. Basic flow

* Hospital administrative staff completes a hospital bed booking form for Patient A. This includes entering the Patient A’s details, Medicare number and the planned procedure.
* Based on the Patient A’s procedure and medical condition, the system determines the appropriate ward in the hospital.
* The system then checks if beds are currently available in that ward.
* The system finds a bed for Patient A and confirms the booking.
* The system then determines Patient A’s next transition based on their medical condition and books a bed in that ward. e.g. from recovery ward bed to hospital room bed.
* The system would continue to determine Patient A’s next transition based on their medical condition. This would conclude with the discharge of the patient from the hospital.

9. Alternative path

* Hospital administrative staff completes a hospital bed booking form for Patient A. This includes entering the Patient A’s details, Medicare number and the planned procedure.
* Based on the Patient A’s procedure and medical condition, the system determines the appropriate ward in the hospital.
* The system then checks if beds are currently available in that ward.
* There is currently no bed available so the system determines when a bed would become available. This would be based on the current medical conditions of the other exiting patients and when they would likely transition to another ward or be discharged.
* The system also determines when subsequent beds would be available as the Patient A transitions through the hospital.
* Once the system has determined the alternative path the bed booking is then confirmed for Patient A.

## 2.2 Functional Requirements

### 2.2.1 Let’s Mine Chess

The system shall:

FR1: Read the inputted chess dataset.

FR2: Read the inputted chess openings dataset.

FR3: Recognise the determined chess openings that have been inputted into the system.

FR4: Flag where a chess opening occurs in the dataset.

FR5: Be able to remove data to replicate real life situations of incomplete datasets.

FR6: Flag chess openings when some of the data is removed.

FR7: Determine the accuracy of predicting a chess opening when some of the data is removed.

FR8: Be easily transitioned to read other datasets with similar patterns eg. Healthcare data.

FR9: Link a chess opening to the game outcome.

FR10: Determine each chess opening’s chance of winning or losing.

### 2.2.2 Complete a triage booking form

The system shall:

FR11: Allow patients to create a new booking, upon arriving at the Emergency Department.

FR12: Allow patients to enter their personal information into the booking form, including name, age, gender, and Medicare number.

FR13: Allow patients to enter their medical symptoms into the booking form.

FR14: Recognise the symptoms entered into the booking form.

FR15: Determine possible diagnosis for the patient, depending on the symptoms entered into the booking form.

FR16: Classify the case as either major or minor, depending on the symptoms entered into the request.

FR17: Request further information, including possible tests, if the booking is classified as a minor case.

FR18: Class the patient as red, amber, or green flag, if the booking is classified as a minor case.

FR19: Request a doctor’s consultation if the booking is flagged as red or amber.

FR20: Request a nurse consultation if the booking is flagged as green.

FR21: Allow for the treating physician to enter the outcomes into the booking form.

FR22: Allow for the treating physician to close the case at the completion of the episode.

### 2.2.3 Hospital Bed Booking

The system shall:

FR23: Allow administration staff to create a hospital bed booking form.

FR24: Allow administration staff to enter patient’s personal details including name, age, gender, Medicare number and planned procedure.

FR25: Determine the appropriate ward for the patient’s bed, depending on the procedure and medical conditions.

FR26: Check the determined ward has a bed available for the patient.

FR27: Flag with the booking if a bed is not available in the most suitable ward.

FR28: Confirm the booking in the ward when bed is available.

FR29: Determine the patients possible transition wards required, for example recovery ward to paediatrics ward.

FR30: Book beds in multiple wards, if required.

FR31: Display the number of beds available in each ward for administrative staff to view, without creating a ‘faux’ patient.

FR32: Allow administration staff to close the booking when the patient is discharged from the hospital.

## 2.3 Non-Functional Requirements

Unlike the functional requirements section, the non-functional requirements have been grouped by types rather than use cases, with the assumption that all use cases will have similar requirements. However, the main focus of the non-functional requirements section is the Let’s Mine Chess use case.

### 2.3.1 Usability

The system must:

NFR1: Have a user interface that is easy to navigate.

NFR2: Provide clear instructions and feedback to the user.

NFR3: Provide a seamless user experience with minimal additional learning.

### 2.3.2 Reliability

The system must:

NFR4: Have a high availability of 99 per cent uptime.

NFR5: Be able to handle errors if they occur.

NFR6: Provide a meaningful error message to the user if an error occurs.

### 2.3.3 Performance

The system must:

NFR7: Follow the date format in the determine chess dataset: year.month.date.

NFR8: Process the chess data within the determined acceptable timeframe of 100,000 moves in 5 mins.

NFR9: Be capable of handling of 20 per cent data loss with at least 90 per cent accuracy.

NFR10: Utilise efficient indexing mechanisms to quickly retrieve the relevant chess data.

### 2.3.4 Scalability

The system must:

NFR11: Be capable of handling increasing amounts of data without performance degradation.

NFR12: Support the additions of new data without requiring major configurations, including different types of data, such as medical data.

NFR13: Be designed to allow for future enhancements and new features without significant redesign.

### 2.3.5 Supportability

The system must:

NFR14: Be compatible with various operating systems including Windows, macOS and Linux.

NFR15: Be compatible with multiple web browsers including Google Chrome and Safari.

NFR16: Be created in KNIME and integrate with Python.

NFR17: Have a well-documented codebase to allow for easy understanding for new developers.

Rationale: The team may not always have ownership of this project, with the client possibly wishing to extend the research beyond the project scope. As such all parts of the system should be well documented.

### 2.3.6 Security

The system must:

NFR18: Ensure that the chess data is securely stored and transmitted.

NFR19: Have measures in place to prevent unauthorised access to the data.

NFR20: Manage user sessions securely, including timeout mechanisms for inactive sessions.

### 2.3.7 Accuracy

The system must:

NFR21: Accurately identify chess openings based on the input chess openings dataset.

NFR22: Calculate the win percentages precisely and reflect the actual data.

NFR23: Implement anomaly detection mechanisms to flag unusual data entries.

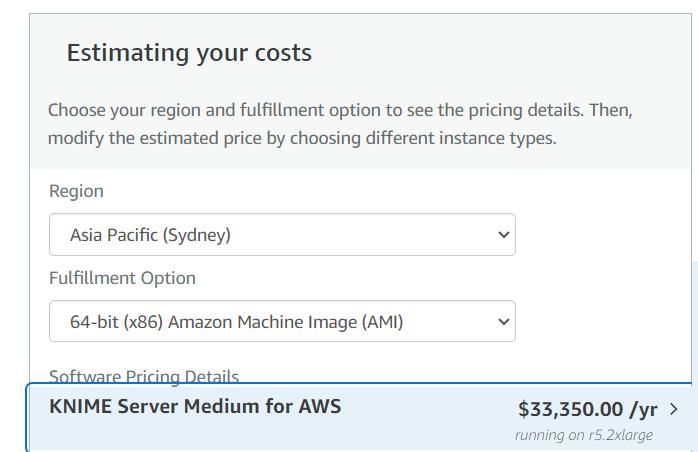
NFR24: Calculate confidence intervals for win percentage statistics.

# 3. References

Amazon Web Services, 2024. **KNIME Server Medium for AWS**. <https://aws.amazon.com/marketplace/pp/prodview-5kgidq5z4lufo#pdp-pricing> [Accessed 6 July 2024].

# 4. Appendix A – AWS Estimate

Esitmated cost for deployment of an AWS KNIME Server for 12 months, in USD.



# 5. Appendix B – Online Document Version

For full version history and document information please access the document via the below link. This link will take you to the Word online version on SharePoint. This document is also saved in the Group C Microsoft Teams Channel in Files.

<https://mymailunisaedu.sharepoint.com/:w:/s/USO_CapstoneProjectSP4SP62024-GroupC/EWKryANji3RPsPtWkiVAdfoBxQGf-2G_rQZgPq583z6GHA?e=FPPtgE>