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Software Engineering 2 Requirements Analysis and Specification Document

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1 | Introduction

Online coding challenges and platforms have become an essential resource for programmers and developers in the modern tech landscape. These platforms provide a versatile means to enhance coding skills, offer practical learning experiences, and promote a competitive and engaging approach to problem-solving. Additionally, participation in such platforms can prepare individuals for tech industry job interviews, as many companies utilize similar coding challenges during their recruitment processes. In summary, these online coding challenge platforms are invaluable tools for skill development, community engagement, and professional growth in the ever-evolving field of programming.

What makes the CodeKataBattle platform even more compelling is the involvement of experienced educators who create coding battles. These experts design challenges that are not only instructive but also thought-provoking, ensuring a rich and educational experience for participants.

Moreover, these platforms often facilitate the creation of groups, enabling collaborative problem-solving and enhancing team working skills. Users can form teams, tackle challenges together, and learn from one another's approaches. This group dynamic adds an extra layer of motivation and shared learning experiences, enhancing the value of these platforms for participants.

1.1. Purpose

1.1.1. Goals

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1.2. Scope

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1.2.1. World Phenomena

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1.2.2. Shared phenomena

ID	Description	Controller	Observer
SP1	The ED creates an account in the CKB system	ED	CKB
SP2	The ED logs in his account in the CKB system	ED	CKB
SP3	The ED logs out of his account from the CKB system	ED	CKB
SP4	The ED creates a tournament	ED	CKB
SP5	CKB adds the tournament to the ED's tournament list	CKB	ED
SP6	The ED can checks his tournament list	ED	CKB
SP7	The ED grants other EDs the permission to create battles within a tournament	ED	CKB
SP8	The ED creates a battle in a specific tournament	ED	CKB
SP9	CBK adds the battle to the ED's battle list	CKB	ED
SP10	The ED can checks his battle list	ED	CKB
SP11	The ED uploads the code kata in the battle	ED	CKB
SP12	The ED sets the minimum and the maximum number of students per group for the battle	ED	CKB

SP13	The ED sets a registration deadline to the battle	ED	CKB
SP14	The ED sets a final submission deadline to the battle	ED	CKB
SP15	The ED sets additional configurations for scoring in the battle	ED	CKB
SP16	The ED sets the badges that STs could be awarded in the battle	ED	CKB
SP17	The ED sets the parameters of the badges that STs could be awarded in the battle	ED	CKB
SP18	The ST creates an account in the CKB system	ST	CKB
SP19	The ST logs in his account in the CKB system	ST	CKB
SP20	The ST logs out of his account from the CKB system	ED	CKB
SP21	CKB notifies STs that a tournament has been created	CKB	ST
SP22	CKB notifies STs that a battle has been created	CKB	ST
SP23	The ST subscribes to a specific battle before the registration deadline	ST	CKB
SP24	CKB adds the tournament to the ST's battle list	CKB	ST
SP25	The ST creates a STg for the battle	ST	CKB
SP26	The ST invites other STs to join his STG for a battle	ST	CKB
SP27	CKB sends a notification to the ST when he receives ain invitation to join a STG	CKB	ST
SP28	The ST accepts other ST's invitations to join their STG fot a battle	ST	CKB
SP29	CKB adds the STs to the STG	CKB	ST
SP30	CKB creates a GH repository containing the code kata and sends the lik to all STs registered in the battle	CKB	ST

SP31	The ST commits a new version of his code	ST	CKB
SP32	CKB runs the tests on the source code	CKB	ST
SP33	CKB updates the score of the STG on the battle's leaderboard	CKB	ST
SP34	CKB updates the score of the ST on the tournament's leaderboard	CKB	ST
SP35	STs can view the current ranks evolving during the battle	ST	CKB
SP36	EDs can view the current ranks evolving during the battle	ED	CKB
SP37	During the consolidation stage, EDs can manually modify the scores	ED	CKB
SP38	CKB notifies all STs when the final battle ranks are available	CKB	ST
SP39	The ED closes the tournament	ED	CKB
SP40	CKB notifies all the STs involved in the tournament when the final ranks of the tournament are available	CKB	ST
SP41	STs can view the current ranks evolving during the tournament	ST	CKB
SP42	EDs can view the current ranks evolving during the tournament	ED	CKB
SP43	CKB assigns the badges to the STs	CKB	ST
SP44	The ST can visualize the profile of other ST or ED	ST	CKB
SP45	The ED can visualize the profile of other ST or ED	ED	CKB

Table 1.1: Shared Phenomenas.

1.3. Definition, Acronyms, Abbreviations

Acronyms	Definition
RASD	Requirements Analysis & Specification Document
ST	Student
ED	Educator
STG	Student Group
CKB	CodaKataBattle
GH	GitHub
User	All STs and EDs
API	Application Programming Interface
DAX	Domain Assumption X
SPX	Shared Phenomena X
WPX	World Phenomena X
RX	Requirement X

Table 1.2: Acronyms used in the document.

1.4. Revision history

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1.5. Reference Documents

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1.6. Document Structure

The document is divided into six sections, each with its unique focus, as outlined below.

Introduction: In the first section, we lay out the project's objectives, purposes, and offer a concise examination of global and shared phenomena. This section also includes a compilation of abbreviations and definitions that are essential for comprehending the problem.

Overall Description: The second section provides a comprehensive overview of the

problem. It delves into further details about the domain and various scenarios involved, in addition to discussing product and user characteristics, assumptions, dependencies and constraints.

Specific Requirements: The third section is dedicated to an in-depth analysis of the specific requirements. It offers detailed insights into external interface requirements, functional requirements, and performance requirements.

Formal Analysis Using Alloy: The fourth section employs Alloy to conduct a formal analysis. This chapter's primary purpose is to validate the accuracy of the model described in the preceding sections. It focuses on presenting the results of the conducted checks and meaningful assertions.

Effort Spent: Section five outlines the individual efforts contributed by each group member to compose this document.

References: The final section serves as a bibliography, listing the references and additional resources used in the creation of this document.

2 | Overall Description

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2.1.   Product perspesctive

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2.1.1.   Scenarios

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2.1.2.   Class diagrams

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2.1.3.   State diagrams

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2.2.   Product functions

2.2.1.   Requirements

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2.2.2.   Use cases

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2.3.   User characteristic

2.4.   Assumptions, dependencies and constraints

2.4.1.   Domain assumptions

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3 | Specific Requirements

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3.1.   External interface requirements

3.1.1.   User interfaces

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3.1.2.   Hardware interfaces

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3.1.3.   Software interfaces

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3.1.4.   Communication interfaces

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3.2.   Functional requirements

3.2.1.   Requirements

ID	Description
R1	CKB allows unregistered Users to sign up
R2	CKB allows registered EDs to login
R3	CKB allows registered STs to login
R4	CKB allows EDs to create tournaments
R5	CKB allows EDs to grant the permissions of a tournament to other EDs
R6	CKB allows EDs to create battles
R7	CKB allows EDs to uploads the code kata of a battle
R8	CKB allows EDs to set the minimun and the maximum number of STs per group of a battle
R9	CKB allows EDs to set a registration deadline of a battle
R10	CKB allows EDs to set a submission deadline of a battle
R11	CKB allows EDs to set additional configuration for the scoring system of a battle
R12	CKB allows EDs to set functional aspects for the scoring system of a battle
R13	CKB allows EDs to create new badges

R14	CKB allows EDs to choose the rules realtes to the awrdubg of badges
R15	CKB allows EDs to choose which badges to award in a certain tournament
R16	CKB allows EDs to assing a score manually during the consolidationstage
R17	CKB allows EDs to close a tournament
R18	CKB allows EDs to visualize the profile of another User
R19	CKB allows STs to visualize the profile of another User
R20	CKB allows STs to join a tournament
R21	CKB allows STs to join a battle
R22	CKB allows STs to create a new STG
R23	CKB allows STs to join a STG
R24	CKB allows STs to invite other STs in their STG
R25	CKB stores the informations about the Users
R26	CKB shall ensure security of data
R27	CKB sends notifications to every ST when a new tournament is created
R28	CKB sends notifications when a new battle is created to every ST which is participating in the tournament that the battle is part of
R29	CKB sends notifications to a ST when he receives an invitation to be part of STG
R30	CKB creates a GH repository of the code kata when the registration deadline for the battle expires
R31	CKB sends the link of the GH repository to every STG that participates in the battle
R32	CKB evaluates the STG's work every time a push is made on GH and calculates battle score for the STG
R33	CKB updates both the battle leaderboard and the tournament leaderboard once a new score is registered
R34	CKB allows STs to check the leaderboard of a battle
R35	CKB allows EDs to check the leaderboard of a battle
R36	CKB allows EDs to analyze the code of a STG
R37	CKB sends notifications to every STs participating in the battle once the consolidation stage ends
R38	CKB allows STs to check the list of ongoing tournaments
R39	CKB allows EDs to check the list of ongoing tournaments
R40	CKB allows STs to check the leaderboard of a tournaments
R41	CKB allows EDs to check the leaderboard of a tournaments

R42	CKB sends notification to every ST involved in a tournament when the tournament is closed and the final ranks are available
R43	CKB shall communicate with the GH API in order to calculate a new score every time a push action is made by a STG
R44	CKB shall communicate with the external tool in order to calculate the score of a STG
R45	CKB shall communicate with the mailing system in order to allow Users to register their account

Table 3.1: Requirements.

3.2.2. Mapping on goals

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3.2.3. Use case diagrams

3.2.4. Use cases

In this section, they are explained and represented the main identified use cases. There is a table with entry conditions, event flow, exit conditions and exception for each of them, and a sequence diagram that shows the messages exchanged between the entities and the called functions.

UC1. Signup as ED

Actor	ED, email provider
Entry conditions	The ED is not already registered in CKB and has to search the CKB URL in the browser search bar
Event Flow	1 - The application shows the login form
	2 - The ED clicks on "create an account" button
	3 - The application shows the signup form
	4 - The ED inserts his name, surname, nickname, email and password in the form and also ticks on the "Signup as Educator" checkbox

	5 - The ED clicks on the "Register" button
	6 - The application checks all the credentials
	7 - If credentials are correct the application sends a confirmation email to the ED through the email provider.
	8 - The ED clicks on the confirmation link
Exit condition	The application allows the ED to access to the CKB system
Exceptions	- The email address is already linked to an account. In this case an error message is shown and the ED is redirected to the profile creation setting. - Invalid password if it is shorter than 8 characters, if it doesn't have at least 1 number and/or 1 capital letter and/or a special character. In this case an error message is shown and the ED is redirected to the profile creation settings. - The nickname is already used. An error is shown and the ED is redirected to the profile creation settings.

Table 3.2: Signup as ED use case

UC2. Signup as ST

Actor	ST, email provider
Entry conditions	The ST is not already registered in CKB and has to search the CKB URL in the browser search bar
Event Flow	1 - The application shows the login form
	2 - The ST clicks on "create an account" button
	3 - The application shows the signup form
	4 - the ST inserts his name,surname, nickname and password in the form
	5 - The ST clicks on the "Register" button
	6 - The application checks all the credentials
	7 - if credentials are correct the application sends a confirmation email to the ST through an email provider.
	8 - The ST clicks on the confirmation link
Exit condition	The application allows the ST to access to the CKB system

Exceptions	• The email address is already linked to an account. In this case an error message is shown and the ST is redirected to the profile creation settings. • Invalid password if it is shorter than 8 characters, if it doesn't have at least 1 number and/or 1 capital letter and/or a special character. In this case an error message is shown and the ST is redirected to the profile creation settings. • The nickname is already used. An error is shown and the ST is redirected to the profile creation settings.

Table 3.3: Signup as ST use case

UC3. Login

Actor	Users
Entry conditions	The User should be registered in CKB and has to search the CKB URL in the browser search bar
Event Flow	1- The application shows the login form 2- The User insert his mail and password in the form 3- The User clicks on the "Login" button 4- The system check the credentials
Exit condition	The application allows the user to access to the CKB system
Exceptions	Incorrect email or password. An error message is shown and the User is redirected back to the Login page

Table 3.4: Login use case

UC4. Join a tournament

Actor	ST
Entry conditions	The Student is correctly logged in. The Student has decided to join a Tournament.

Event Flow	1- The Student search the name or the code of a Tournament into the search b
	2- CKB returns the result from the search.
	3- The Student clicks on the new Tournament's name.
	4- CKB redirects the Student to the main page of the Tournament.
	5- The Student clicks on the "Join Tournament" button.
	6- CKB saves the Student as one of the competitors of the Tournamen
	7- CKB shows a confirm message and redirects the Student to the page th
	contains the current Leaderboard of the Tournament.
Exit condition	The Student is now part of the Tournament and will be notified whenever a n
	Battle will be available.
Exceptions	- The Tournament already ended. In this case is shown an error messa the User is redirected to the final leaderboard of the Tournament. - The student already joined the Tournament. In this case CKB will not sh any error messages, but will redirect the Student to the current Lead board of the Tournament. - The Deadline already expired. An error message is shown and the ST redirected back to the Home Page.

Table 3.5: Join a tournament use case

UC5. Join a battle

Actor	ST
Entry conditions	The Student is correctly logged in and it is in the Tournament main page (one with the leaderboard). The Student has decided to join a Battle.
Event Flow	1- The Student click on the button "Go to battles"
	2- CKB redirects the student to the page that has the list of all the Battles the Tournament.
	3- The Student clicks on the "subscribe" button near the battle name.
	4- CKB redirects the Student to the CreateGroup page of the Battle.
	5- CKB redirects the Student to the CreateGroup page of the Battle.
Exit condition	The Student, after the subscription deadline end, will be able to create a gr and then confirm the participation to the battle

Exceptions	• The Student isn't in the Tournament that this Battle is part of. In this case CKB shows an error message, the User is redirected back to his main page/dashboard • The Battle already ended or already started. In this case CKB shows an error message, the User is redirected to the final leaderboard of the Battle. • The student already joined the Battle. In this case CKB will not show any error messages, but will redirect the Student to the CreateGroup page.

Table 3.6: Join a battle use case

UC6. Create a group and battle confirmation

Actor	ST
Entry conditions	The Student is correctly logged in and it is in the CreateGroup page. The Student has decided to join a Battle.
Event Flow	1- The Student clicks on the "invite" button and then inserts another student's nickname. 2- CBK checks if the student joined the competition and notifies other students of an invitation. 3- the other student can decide to accept or reject the invitation clicking on the "accept" or "reject" button inside the notification. 4- CKB shows to the Student that creates the group the different state of the various invitation requests (3 state : accepted, rejected, pending)(only the first n-invited players that accept the invite are considered part of the group)(where n is the upper bound threshold). 5- The Student can click on the "Join Battle" button. 6- CKB checks if the number of members respect the limits given by educators during the battle creation. 7- CKB saves the Student and the group as one of the competitors of the Battle 8- CKB shows a confirmation message and redirects all the Students to the group to the main page of the Battle (the one with the leaderboard).
Exit condition	The Student is now a competitor in the Battle and he can starts committing after the creation group deadline expires

Exceptions	
	• The group already joined the Battle. In this case CKB will not show a error messages, but will redirect the Student to the current Leaderboa of the Battle. • The number of students in the group is wrong. CKB will show an er and redirect the students to the CreateGroup page. • If the creation group deadline and all the students without group or all groups not confirmed will be kicked out from the battle • if the invited student isn't already joined in the competition or if the ni name does not exist, CKB sends an error and redirects the students to CreateGroup page.

Table 3.7: Create a group and battle confirmation use case

UC7. Create a tournament

Actor	ED
Entry conditions	ED is correctly logged in. The ED has decided to create a tournament. The I is on his profile page.
Event Flow	1- The ED clicks on "Create a Tournament" button 2- CKB return the create tournament form 3- The ED writes the Tournament name, sets the deadline for STs to subscr and chooses and writes the other EDs nicknames to grant them permissions create new battles 4- CKB stores the data of the Tournament 5- CKB sends a notification to the chosen EDs 6- CKB notifies all the STs of the creation of the Tournament 7- CKB return the Tournament main page
Exit condition	The tournament is correctly created and a confirmation message is shown to ED

Exceptions	
	• The Tournament's name is null or already exists. An error message is shown and the ED is redirected back to create tournament settings. • The EDs chosen are non-existent, or the creator chooses other ED that have already permission in this Tournament. An error message is shown to the ED and the ED is redirected to create tournament settings. • The Deadline is a date before the day the Tournament is created. An error message is shown to the ED and a new Deadline has to be chosen and the ED is redirected to create tournament settings.

Table 3.8: Create a tournament use case

UC8. Create a battle

Actor	ED
Entry conditions	ED is logged in. ED is in the Tournament page. ED has decided to create a Battle
Event Flow	1- ED clicks on "Create new battle" button 2- CKB redirect ED to the create battle form 3- ED writes the Battle name 4- ED sets the minimum and maximum number of students per group 5- CBK checks the battle name, the minimum and the maximum 6- CKB redirect ED to the upload code kata form 7- ED uploads the code kata to be resolved 8- CKB save the code kata sended 9- CKB redirect ED to the deadline and additional condition form 10- ED sets a registration deadline 11- ED sets a final submission deadline 12- ED sets additional configurations for scoring 13- CKB check deadline 14- CKB create a new Battle 15- CKB sends a notification to all STs subscribed to the Tournament
Exit condition	The battle is correctly created and the ED is redirected to the battle main page

Exceptions	
	• The Battle's name is null or already exists. An error message is shown, ED is redirected back to the create battle settings.
	• The maximum number of students per group is lesser than the minimu An error message is shown to the ED and the ED is redirected to the crea battle settings.
	• The minimum number of students per group is lesser or equal than ze An error message is shown to the ED and the ED is redirected to the crea battle settings.

Table 3.9: Create a battle use case

3.3. Performance requirements

3.4. Design constraints

3.4.1. Standard compliance

The system must be compliant to the EU's GDPR (General Data Protection Regulation), a set of regulations that is designed in order to protect the personal data, the privacy and security of the EU's citizens.

3.4.2. Hardware limitations

The only hardware limitations are the support for a reliable internet connection and for a Web Browser.

3.4.3. Any other constraints

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3.5. Software system attributes

3.5.1. Reliability

The system has to be fault tolerant in order to prevent the propagation of errors and to guarantee a continuous usability of the system.

3.5.2.   Availability

The system must be available the most time possible, with a minimum value of 99.9% (three-nines) of time. In this way the system will be unavailable for only 8.76 hours a year.
It shall be prevented a case scenario in which a mainta break occurs near to Battle's end, therefore there must be as few maintenance breaks as possible, with them possibly at nightime.

3.5.3.   Security

The system must control the access rights of the users. The system shall grant both authentication, verifying the identity of the users that attempt to login and authorization, verifying the permission of the already logged users to perform certain requested actions. Measures to protect the database will be adopted, such as defense against query injections, and password and users' personal data stored will be encrypted.

3.5.4.   Maintainability

The system must be designed using scalable and reusable models in order to permit future addition of features with minimum effort. Ordinary maintenance has to be scheduled at nightime, in order to keep the services available when the user traffic is high.

3.5.5.   Portability

The system must be accessible by the users from every kind of Web Browser. There are no particular portability requirements server side.

4 | Formal Analysis Using Alloy

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