Yarmouk University

Hijjawi Faculty for Engineering Technology

Computer Engineering Department

CPE-350: Object Oriented Modeling and Applications

Tennis Game Project

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Task #1: Domain Class Model

- Preparing the problem statement;
- Identifying objects and classes;
- Developing a data dictionary;
- Identifying associations between classes;
- Identifying attributes of classes and association classes;
- Structure object classes using inheritance;
- Verify access paths for likely queries; and
- Iteratively refine the model.

Step 1: Preparing the problem statement

"The game is played by two players. Each of whom wields a racket, indicated by the black vertical lines on the short sides. Each player can move his or her racket up or down .The player on the right will use the key ↑ and ↓ and the player on the left will use A and Z keys as "up" and "down" keys. A red ball bounces back and forth (and up and down) in the playing area, and each player has to hit the ball with the racket so that the ball does not touch the player's short side. If this happened, the opponent gets a point. The point is displayed at the side of the playing area.

When play begins, the ball travels relatively slowly from the left but every time a player is able to hit the ball, its speed increases, making it more difficult to hit. The speed of the ball increases until one of the players misses it and it bounces against one of the short sides. The ball then returns to the speed it had all the beginning of the game.

The game begins when we click on the "New game" button. A game is interrupted automatically when one of the players has reached 10 points. A game can be temporarily interrupted if the "Pause" button is clicked and continued when the "continue" button is clicked. The "Exit" button terminates the game. The actual game played can be interrupted and a new game begun instead, by click on the "New game" button.

When the "New game" button is clicked , a new window pops up with three buttons, one with the text "One player", one with text "Two Players ", in addition to the "cancel" button. When the user clicks on the button "Two Player", the game will functions as before but when the user clicks on the button "One Player", the player on the left will be replaced by the computer. The program will then automatically move the left-hand racket so that it always hit the ball. Because the human player will not get any points , it will not matter that these are not shown; instead , the right-hand label should be allowed to display the number of times the human player has succeeded in hitting the ball before he or she loses by 10:0. A player's skills can then be judged by the number of hits made. The cancel button cancels starting a new game and returns to the previous state.

There is an aspect of the program that is not obvious from the figure. The playing area's width and length can be changed at any time by dragging on the window. So the game can be made easier or more difficult and play will be adjusted automatically to continue on the altered "court"."

Step 2: Identifying objects and classes

-all objects and classes

Racket (tangible thing)	Red ball(attribute)
Ball (tangible thing)	Playing area (tangible)
Players (roles played)	speed(attribute)
New game(event)	Ball (tangible)
End game(event)	exit (event)
pause(event)	Continue (event)
Short side(concept)	Computer (roles played)
Width and length (attribute)	Position (attribute)
Black vertical line(attribute)	Control key (concept)
Points (concept)	Right player (roles played)
Left player (roles played)	Number of hits (concept)
Game (concept)	Moving (concept)

-The Generalization Relationship

player(role played)	Racket (concept)
Ball (concept)	Playing area(concept)
Control key (concept)	Game (concept)

-Inappropriate Classes

Black vertical line (attribute)	Red ball(attribute)
Position (attribute)	speed(attribute)
New game(operation)	Number of hits (redundant)
End game(operation)	exit (operation)
pause(operation)	Continue (operation)
Width and length (attribute)	Playing area (redundant)

-Candidate Classes

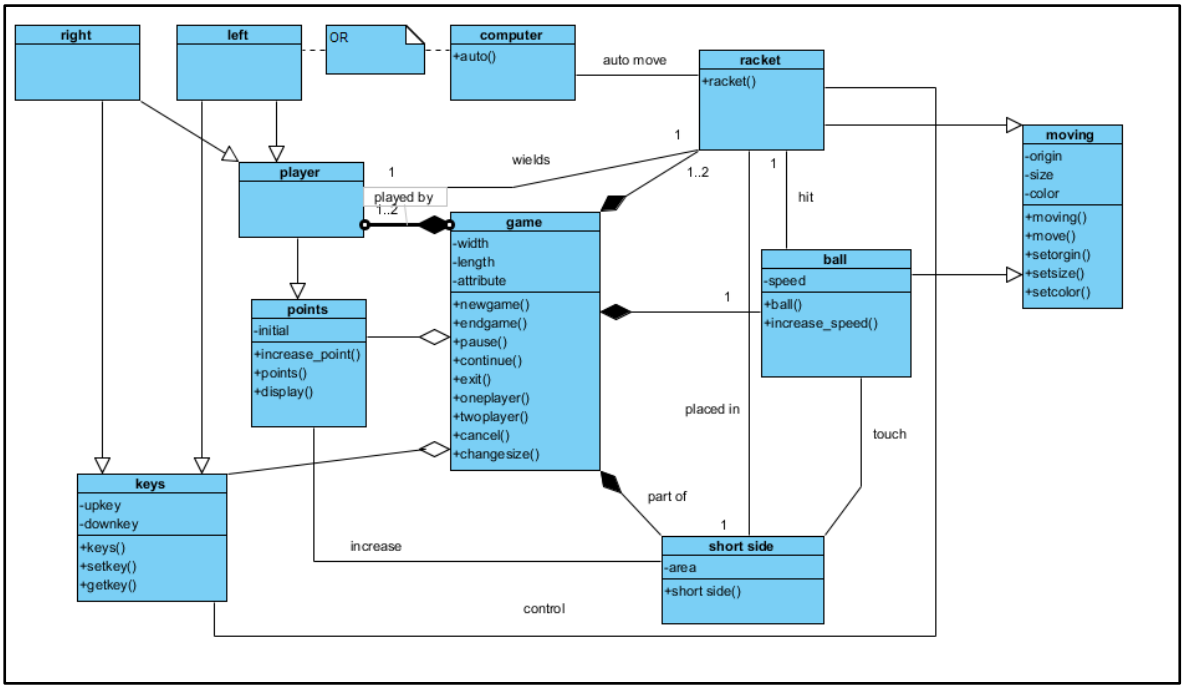
Racket (tangible thing)	Game (concept)
Ball (tangible thing)	Control key (concept)
Players (roles played)	Short side(concept)
Points (concept)	Right player (roles played)
Left player (roles played)	Computer (roles played)
Moving (concept)	

Step 3: Developing the Data Dictionary

Class	Definition
Racket	Hits the ball
Ball	Ball is a basic element in this game, moving from one player to another
Players	It's the basic roles played in this game . it will use the racket to hit ball
Points	Counting number of points will the player get.
Game	the main application class
Left player	The player that will be in the left of playing area and use A , Z keys , it can replaced by computer
Right player	The player that will be in the right of playing area and use ↑ ,↓ keys
Computer	Its role as a player it will be in the place of the left player if "one player" option will be chosen
Control key	Its specifies the control keys of the racket according to the type of player
Short side	It's important part of the game. if the ball touch the short side of one player , the opponent will get a point
moving	specifies the initial position and the color and shape for moving object(racket and ball)

Step 4: Identifying associations between classes

Verb phrase	Association
The game is played by two players.	Played by
The game is played by two players. Each of whom wields a racket	Wields, control
a racket that indicated by the black vertical lines on the short sides	Place in
Each player can move his or her racket up or down .The player on the right will use the key ↑ and ↓ and the player on the left will use A and Z keys as "up" and "down" keys	Using
player has to hit the	Hit
the ball with the racket so that the ball does not touch the player's short side. If this happen, the opponent gets a point.	Touch, get



Task #2: Use Case Model

- Identify the major actors;
- Write description to define the roles of each actor;
- Examine the roles of each actor and identify the use cases;
- Draw initial use case diagram;
- Write initial descriptions for the use cases;
- Perform a textual analysis to identify candidate business (domain) objects;
- Develop the base use case descriptions; and
- Iteratively elaborate the base use case descriptions and determine the <<extend>>, <<include>> and generalization relationships. Refine the use case diagram and the use case description to reflect the use case relationships.

Step 1: Identifying the major actors and use cases

- **There are two main actors:**
    1. **Human player**
       - Left player
       - Right player
    2. **Computer**

Step 2: Write description to define the roles of each actor

Actor name	Human player
Description	This actor can control the game by start, pause, exit, continue and change the size the window of the game. She/he can choose one player, two players or cancel button. And hit the ball by wield a racket using the keys

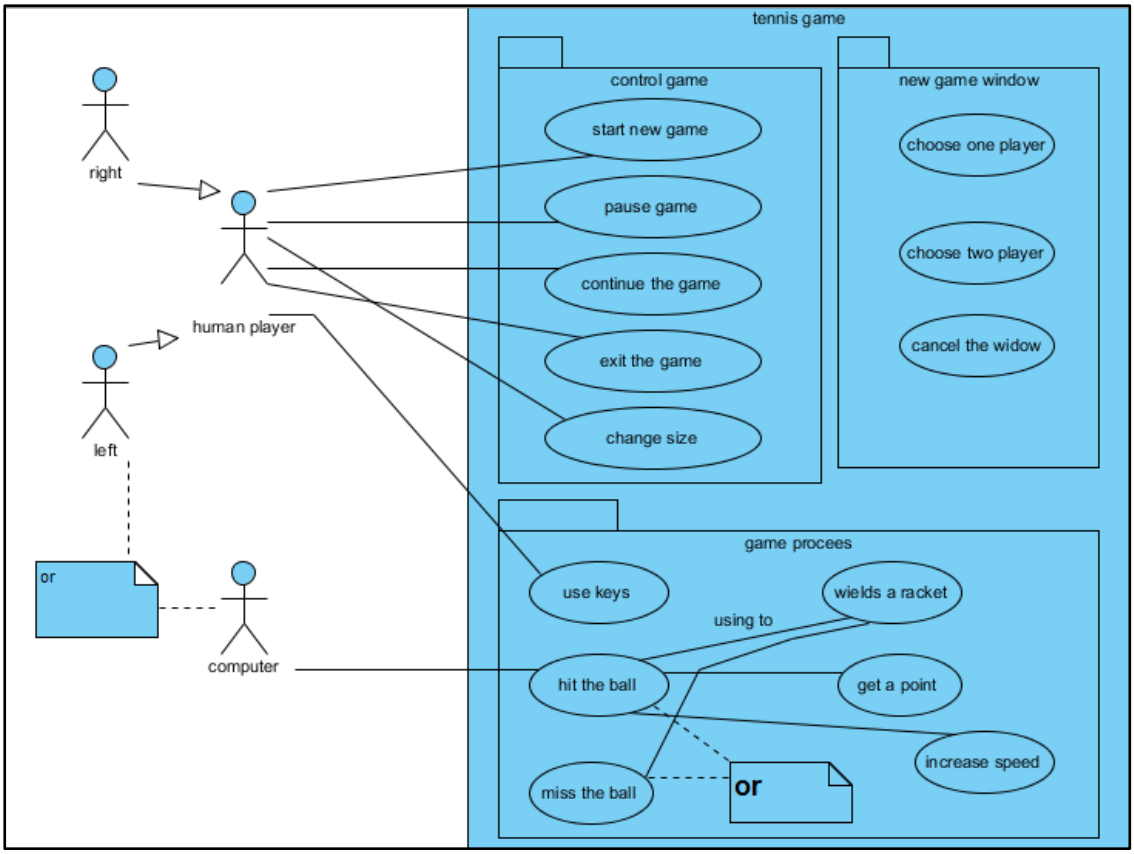
Actor name	computer
Description	This system actor can only hit the ball automatically by implementing a code for that.

Step 3: Identify the use cases

1. **Start new game**
2. **Pause game**
3. **Continue the game**
4. **Exit game**
5. **Choose one player**
6. **Choose two player**
7. **Cancel the window**
8. **Change size**
9. **Hit the ball**

10. **Wields a racket**
11. **Use keys**
12. **Increase speed**
13. **Get a point**
14. **Miss the ball**

Step 4: creating an initial use case diagram



Step 5: initial description of the use cases

Use case: start new game
Use case ID: UC01
Actor: human player
Description: the human player clicks on new game button, then a window will appear with three options: one player, two players and cancel. she/ he can choose any one of them.

Use case: pause game
Use case ID: UC02
Actor: human player
Description: the human player clicks on pause button. This button will interrupt the game and everything will stop.

Use case: continue the game
Use case ID: UC03
Actor: human player
Description: the human player clicks on continue button. This button will continue the interrupted game and everything will continue from the last state.

Use case: exit the game
Use case ID: UC04
Actor: human player
Description: the human player clicks on exit button. This button will exit from the game and everything will not be saved for the next game the player will start

Use case: choose one player
Use case ID: UC05
Actor: -
Description: this is a choice will appear if the human player click on "new game" button. When click on "one player" button the player on the left will be replaced by the computer. The right player will use his/her keys

Use case: choose two players
Use case ID: UC06
Actor: -
Description: this is a choice will appear if the human player click on "new game" button. When click on "two players" button two human players will play using their keys.

Use case: cancel the window
Use case ID: UC07
Actor: -
Description: this is a choice will appear if the human player click on "new game" button. When click on "cancel" button it cancels starting a new game and returns to the previous state.

Use case: wields a racket
Use case ID: UC08
Actor: -
Description: human player use keys to wields a racket (up or down)to hit the ball (keys depend on player name)

Use case: use keys
Use case ID: UC09
Actor: human player
Description: human player use keys to control the movement of the racket

Use case: hit the ball
Use case ID: UC10
Actor: -
Description: when using the keys to control the racket if the racket touches the ball then this action called hitting the ball. And the ball will travel to the opponent side

Use case: get a point
Use case ID: UC11
Actor: -
Description: when using the keys to control the racket if the racket doesn't touch the ball (i.e. ball touch the short side) the opponent gets a point. Its important to know that happen if two players option was chosen.

Use case: miss the ball
Use case ID: UC12
Actor: -
Description: when using the keys to control the racket if the racket doesn't touch the ball (i.e. ball touch the short side) this action called ball missing.

Use case: change size
Use case ID: UC13
Actor: human player
Description: The playing area's width and length can be changed at any time by dragging on the window

Use case: increase speed
Use case ID: UC14
Actor: -
Description: When play begins, the ball travels relatively slowly from the left but every time a player is able to hit the ball, its speed increases

Step 6: Perform a textual analysis to identify candidate business (domain) objects

- **It's done before in task #1.**

Step 7: Developing the base use case description

Use case name	Start new game
Use case ID	UC01
Super use case	-
Actor(s)	Human player
Brief description	The human player clicks on new game button.
Preconditions	Human player must run the application game
Post-conditions	A window will appear with three options
Flow of events	1. Human player will run the tennis game 2. Click new game button 3. Window will appear with three choices 4. Extend(choose one player), (choose two player),(cancel the widow)
Alternative flows and exceptions	At any time the human player can choose it even that a game currently run
Priority	High

Use case name	pause game
Use case ID	UC02
Super use case	-
Actor(s)	Human player
Brief description	The human player clicks on pause button. This button will interrupt the game and everything will stop.
Preconditions	Human player must run the application game
Post-conditions	Interrupt the game and everything will stop.
Flow of events	1. Human player will run the tennis game 2. Click pause button
Alternative flows and exceptions	At any time the human player can choose it even that a game currently run
Priority	High

Use case name	continue the game
Use case ID	UC03
Super use case	-
Actor(s)	Human player
Brief description	The human player clicks on continue button. This button will continue the interrupted game and everything will continue from the previous state.
Preconditions	Human player must run the application game
Post-conditions	Continue the interrupted game and everything will continue

	from the previous state.
Flow of events	1. Human player will run the tennis game 2. Click continue button
Alternative flows and exceptions	This button used after click "pause" button , otherwise it will not affect any thing
Priority	High

Use case name	exit the game
Use case ID	UC04
Super use case	-
Actor(s)	Human player
Brief description	The human player clicks on exit button. This button will exit from the game .
Preconditions	Human player must run the application game
Post-conditions	This button will exit from the game and everything will not be saved for the next game the player will start
Flow of events	1. Human player will run the tennis game 2. Click exit button
Alternative flows and exceptions	-
Priority	High

Use case name	choose one player
Use case ID	UC05
Super use case	-
Actor(s)	Human player
Brief description	This is a choice will appear if the human player click on "new game" button. When click on "one player" button the player on the left will be replaced by the computer. The right player will use his/her keys
Preconditions	Human player must run the application game and click "new game button"
Post-conditions	The player on the left will be replaced by the computer. The right player will use his/her keys
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Choose "one player" button
Alternative flows and exceptions	-
Priority	low

Use case name	choose two players
Use case ID	UC06
Super use case	-
Actor(s)	Human player

Brief description	This is a choice will appear if the human player click on "new game" button. When click on "two players" button two human players will play using their keys.
Preconditions	Human player must run the application game and click "new game button"
Post-conditions	two human players will play using their keys
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Choose "two players" button
Alternative flows and exceptions	-
Priority	low

Use case name	cancel the window
Use case ID	UC07
Super use case	-
Actor(s)	Human player
Brief description	this is a choice will appear if the human player click on "new game" button. When click on "cancel" button it cancels starting a new game and returns to the previous state.
Preconditions	Human player must run the application game and click "new game button"
Post-conditions	Cancels starting a new game and returns to the previous state.
Flow of events	1. Human player will run the tennis game 2. Click "new game" button

	3. Choose "cancel" button
Alternative flows and exceptions	-
Priority	high

Use case name	wields a racket
Use case ID	UC08
Super use case	Use keys
Actor(s)	Human player
Brief description	human player use keys to wields a racket (up or down)to hit the ball (keys depend on player name)
Preconditions	Human player must run the application game and click "new game button" and use the keys
Post-conditions	Moving the racket up and down to hit the ball
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Control the keys that Inherits from use keys
Alternative flows and exceptions	-
Priority	High

Use case name	use keys
Use case ID	UC09
Super use case	-
Actor(s)	Human player
Brief description	human player use keys to control the movement of the racket
Preconditions	Human player must run the application game and click "new game button" and use the keys
Post-conditions	Moving the racket up and down to hit the ball
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Control the keys
Alternative flows and exceptions	-
Priority	High

Use case name	hit the ball
Use case ID	UC10
Super use case	-
Actor(s)	Human player
Brief description	When using the keys to control the racket if the racket touches the ball then this action called hitting the ball. And the ball will travel to the opponent side

Preconditions	Human player must run the application game and click "new game button" and use the keys to move the racket
Post-conditions	Hit the ball and send it to the opponent side
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Include (wield a racket) 4. Send the ball to opponent side
Alternative flows and exceptions	-
Priority	High

Use case name	get a point
Use case ID	UC11
Super use case	-
Actor(s)	-
Brief description	When using the keys to control the racket if the racket doesn't touch the ball (i.e. ball touch the short side) the opponent gets a point. It's important to know that happen if two players option was chosen.
Preconditions	Human player must run the application game and click "new game button" choose two players and use the keys to move the racket and hit the ball successfully
Post-conditions	A point will be added to the total.

Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Include (hit the ball) 4. Increase the score
Alternative flows and exceptions	A game is interrupted automatically when one of the players has reached 10 points
Priority	High

Use case name	miss the ball
Use case ID	UC12
Super use case	-
Actor(s)	-
Brief description	When using the keys to control the racket if the racket doesn't touch the ball (i.e. ball touch the short side) this action called ball missing.
Preconditions	Human player must run the application game and click "new game button" choose two players and use the keys to move the racket.
Post-conditions	A point will be added to the opponent
Flow of events	1. Human player will run the tennis game 2. Click "new game" button 3. Include (wield a racket) 4. Increase the score
Alternative flows and exceptions	-

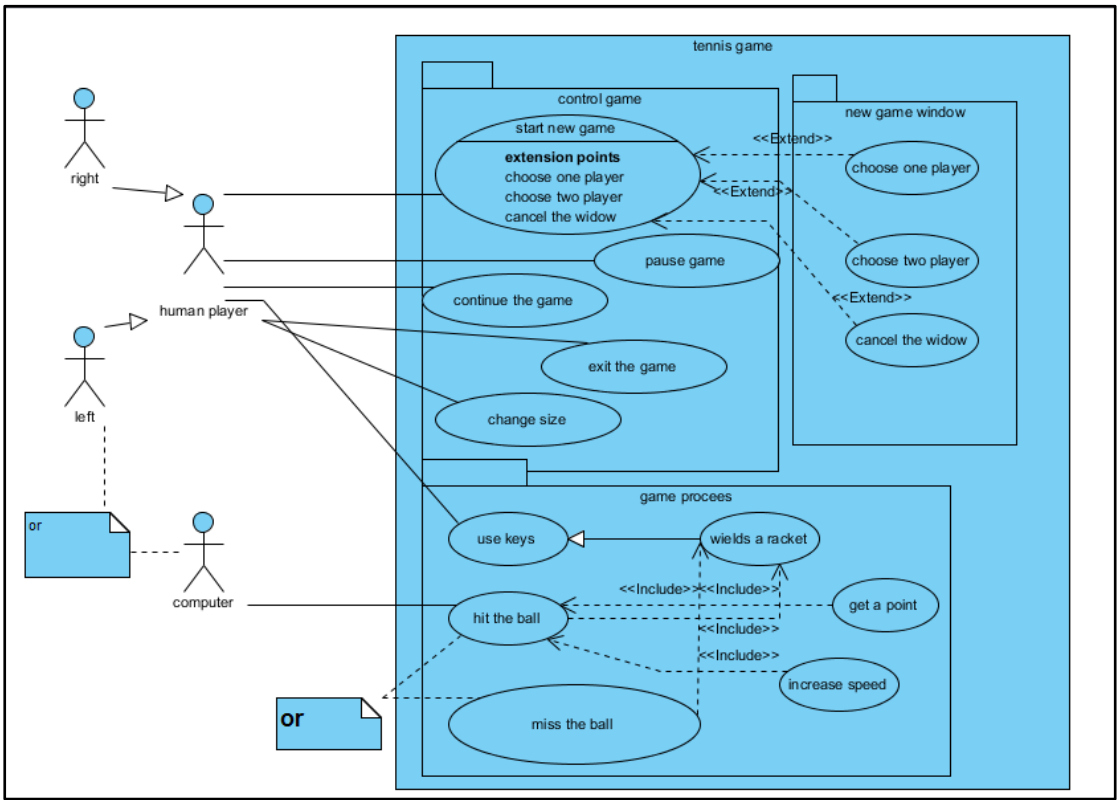
Priority	High

Use case name	Change size
Use case ID	UC13
Super use case	-
Actor(s)	Human player
Brief description	The playing area's width and length can be changed at any time by dragging on the window
Preconditions	Human player must run the application drag the window
Post-conditions	Change the size of the window. So the game can be made easier or more difficult
Flow of events	1. Human player will run the tennis game 2. Drag the window
Alternative flows and exceptions	-
Priority	Low

Use case name	increase speed
Use case ID	UC14
Super use case	-
Actor(s)	-
Brief description	the ball travels relatively slowly from the left but every time a player is able to hit the ball, its speed increases

Preconditions	Hitting the ball successfully
Post-conditions	Increase the speed
Flow of events	1. Include (hit the ball) 2. Increase the speed
Alternative flows and exceptions	-
Priority	high

Step 8: Elaborate the base use case description



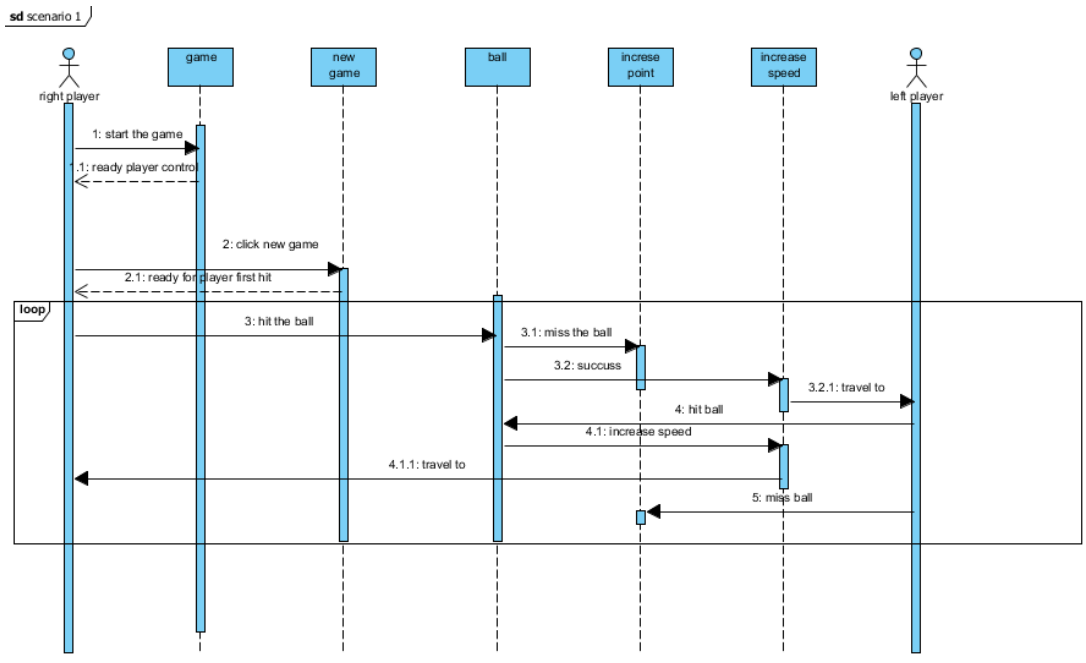
Task #3: Dynamic Modeling and Analysis

- Developing system- level sequence diagrams for use case scenarios.
- Developing three –tier sequence diagrams for the use case scenarios.
- Developing three – tier collaboration diagrams for the use case scenario (optional) for the use case scenarios.
- Developing a state chart diagram for each of the control objects.
- Refining the class diagram that you have developed in task #1 by using the result of steps 2 to 4 above.

Step 1:- Developing system-level sequence diagram

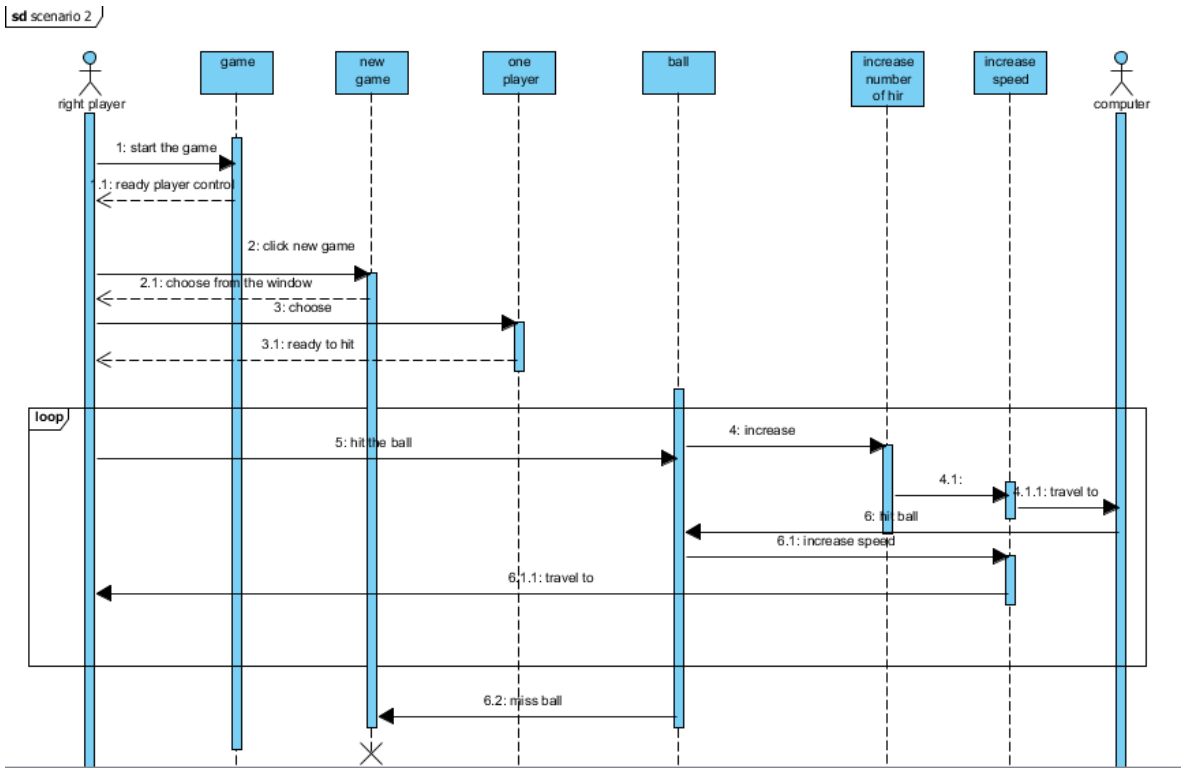
- Scenario #1:

When the user clicks "new game" button for the first time. The game is played by two players. Each player can move his or her racket up or down using keys to hit the ball and for each successful hit ball's speed increase. When the one of the player gets 10 point the game ended.



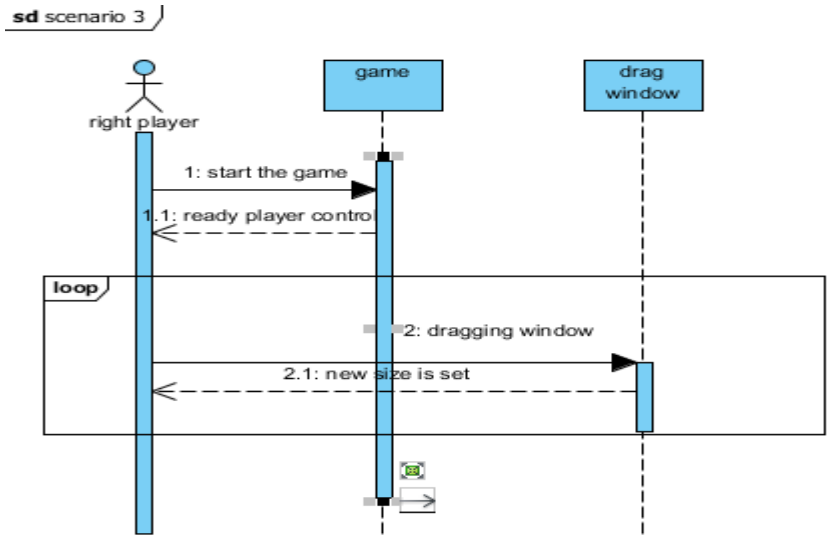
- Scenario #2:

When the user clicks on the button "One Player", then the right player will play with the computer. The program will then automatically move the left-hand racket so that it always hit the ball. Because the human player will not get any points; player's skills can then be judged by the number of hits made. The game ended when the right player miss the ball.



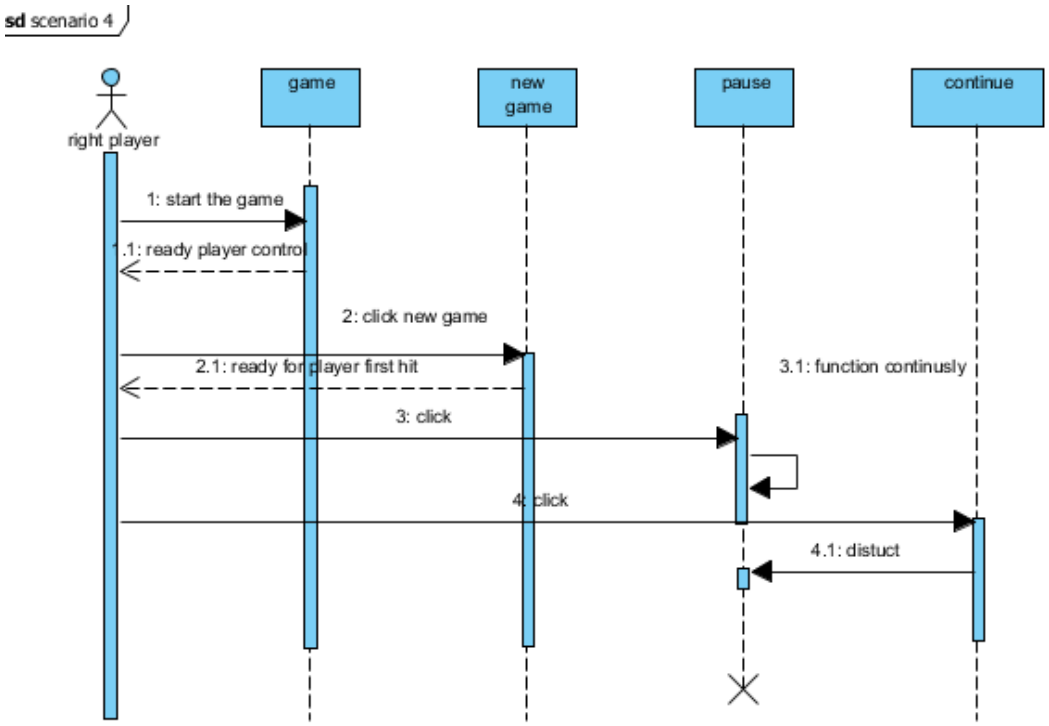
- Scenario #3:

The playing area's width and length can be changed at any time by dragging on the window. So the game can be made easier or more difficult and play will be adjusted automatically to continue on the altered "court".



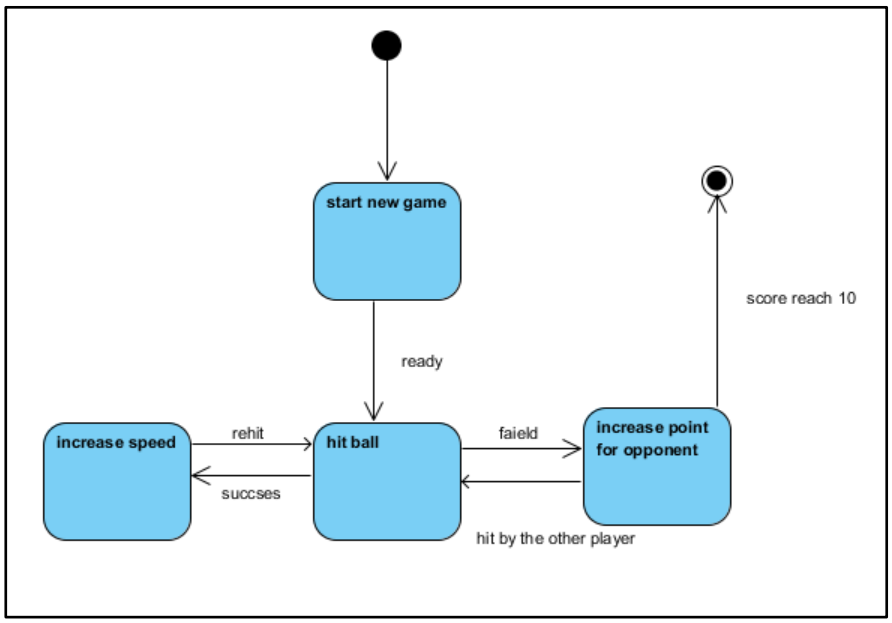
- Scenario #4:

After starting a new game, "Pause" button is clicked. Then the game will wait for player to click "continue" button. After this the game will continued from the previous state

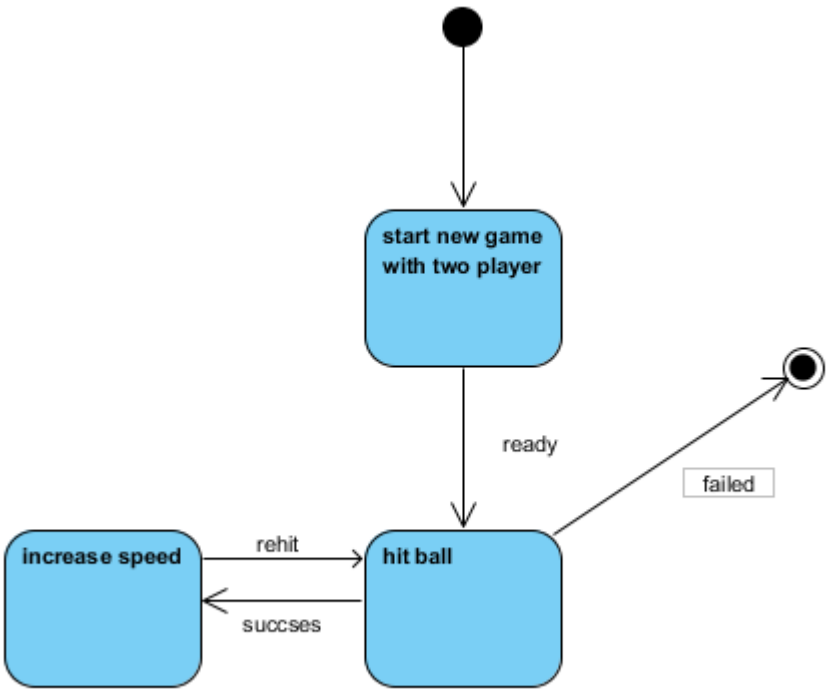


Step2: Developing a state chart diagram for each of the control objects.

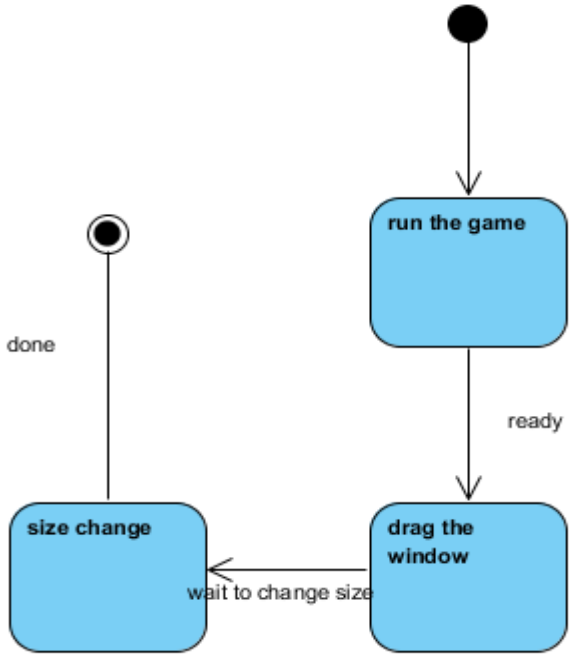
- **Scenario #1**



- **Scenario #2**



- **Scenario #3**



- **Scenario #4**