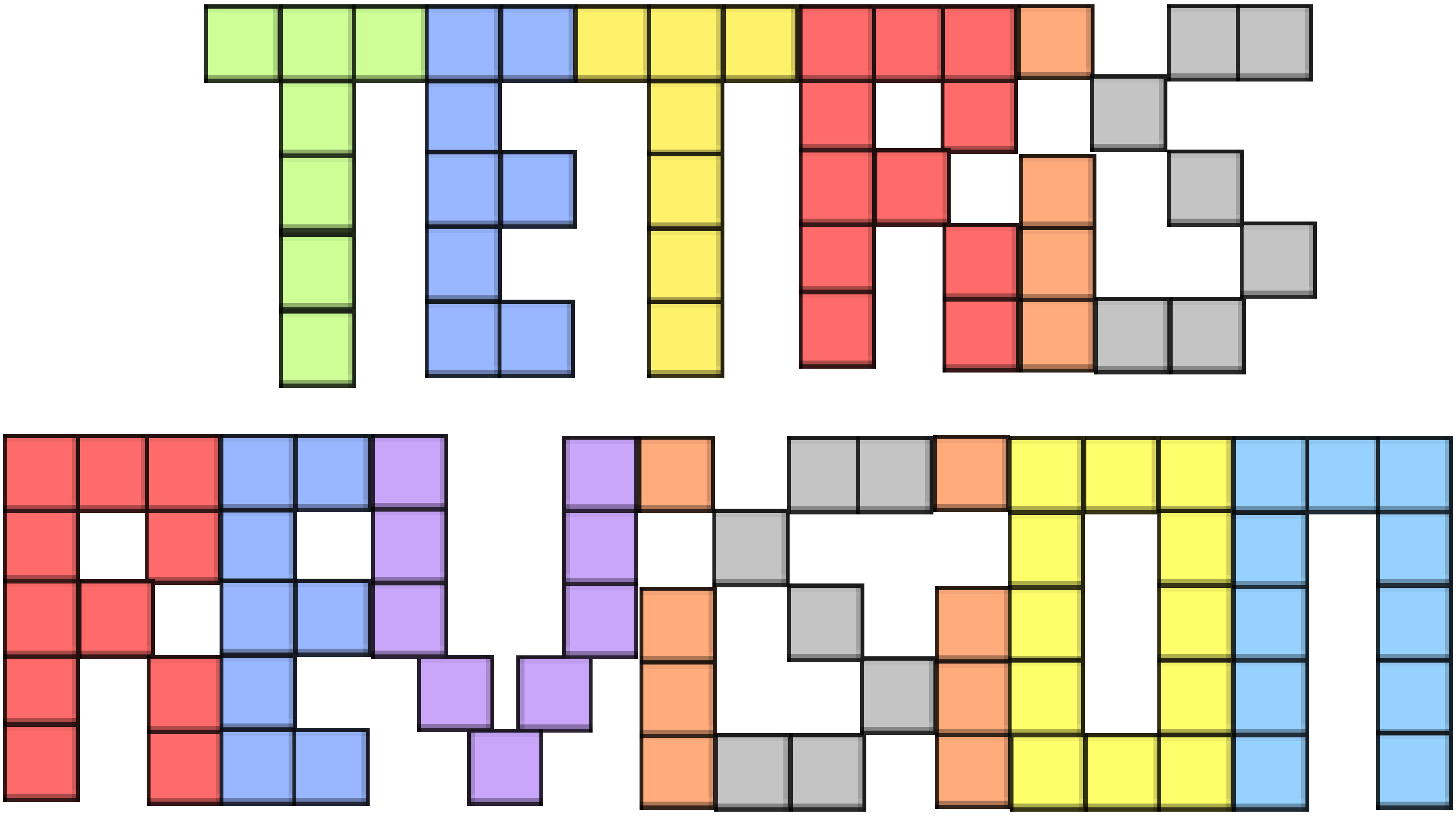
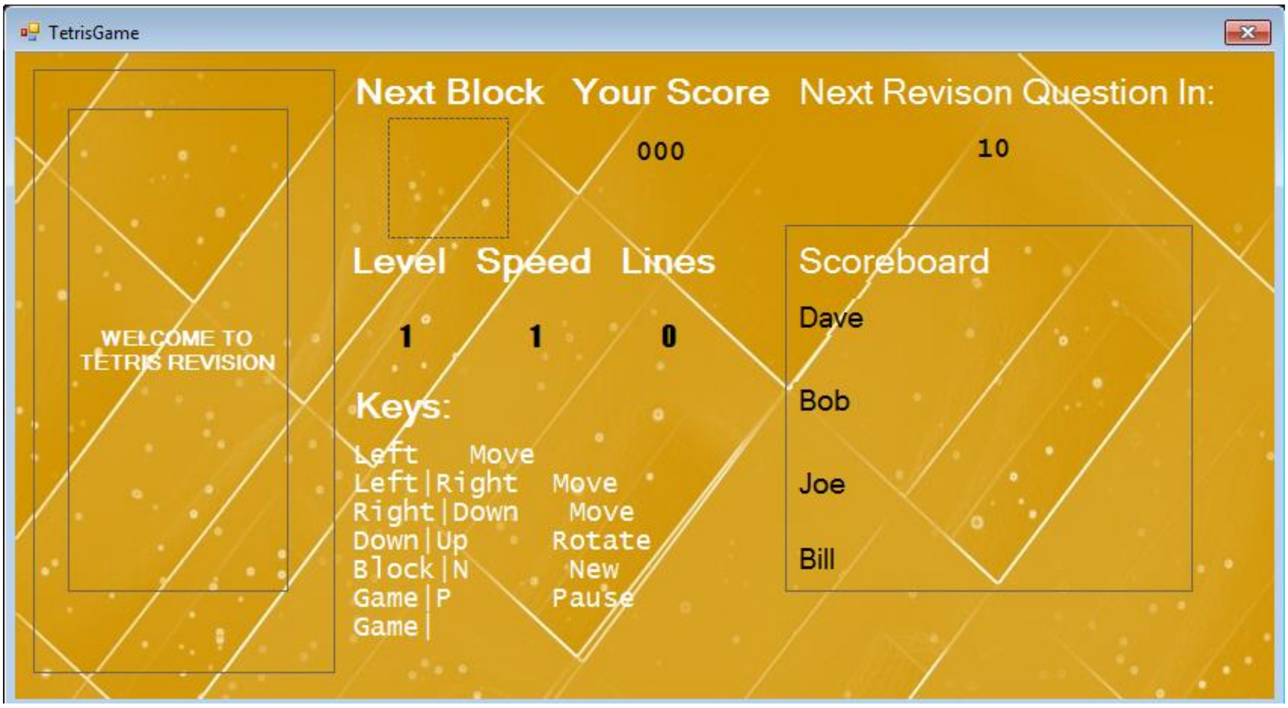




WELCOME TO TETRIS REVISION

Next Block

Your Score

000

Next Revison Question In:

10

Level	Speed	Lines
1	1	0

Keys:

```
Left     Move
Left|Right   Move
Right|Down    Move
Down|Up      Rotate
Block|N       New
Game|P       Pause
Game|
```

Scoreboard

Dave

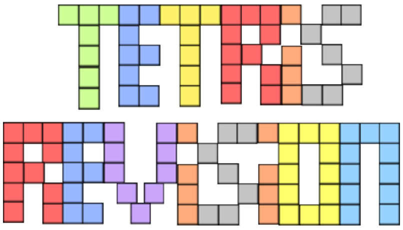
Bob

Joe

Bill

Contents

Harry Rogers



Introduction

I am going to use Windows Visual Basic to code my programme to help high school teachers give revision tasks to students to help with their education. Students will then have more help with learning towards their GCSE's whilst playing Tetris which is a good distraction from the stress of upcoming exams which some students feel. I feel that maths needs a better way to revise for GCSE as I found personally that maths revision for GCSE was difficult. I want to help peers in at lower age group find maths revision easy and fun. Users could use this program as a starter activity during lessons or users could use it as quick revision for maths to help them learn. Furthermore, this will help the national average of students passing maths at GCSE rise which will help everyone as maths is a tool that can help in many areas of working in companies.

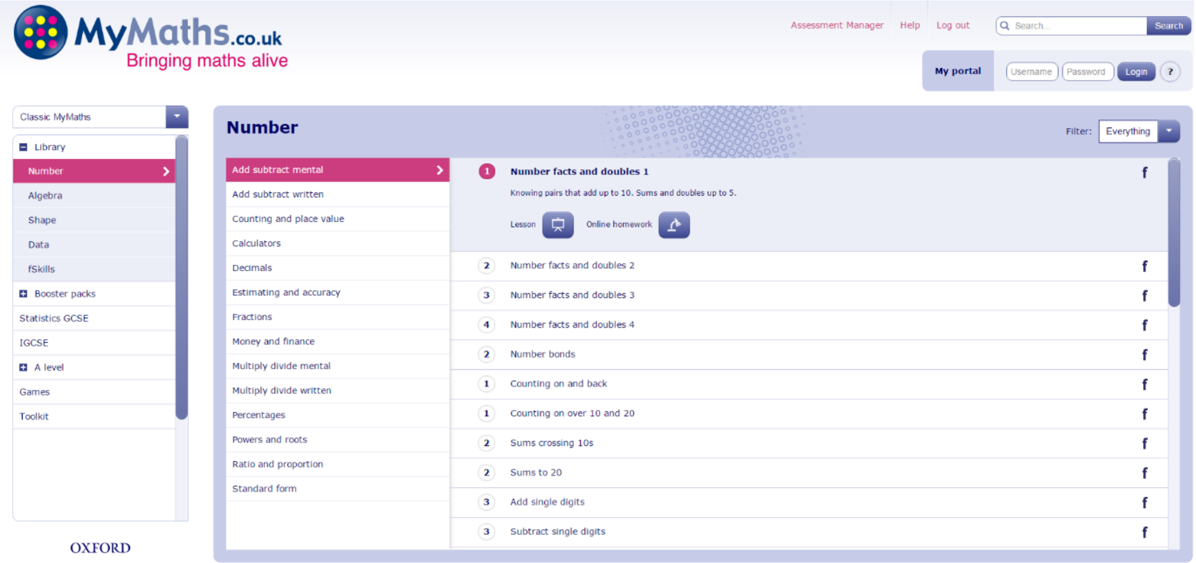
Research

I started to research the problem of the amount of people passing GCSE maths at C grade which in 2015 was 63.3% of A* to C which I believe should be higher and is one of the reasons I have decided to make a maths game to help students revise maths.

I found out that other solutions to this problem were websites such as my maths which is primarily what is being used for students.

MyMaths.co.uk

Advantages	Disadvantages
Simple to navigate.	Answers for all questions can be found online.
Different levels of ability for students.	Not fun or memorable.
Saves specific scores for students.	Only gives correct answers.
Has specific areas of maths.	Logins can be forgotten.
Lessons on how to do maths.	Not always clear what is being asked.



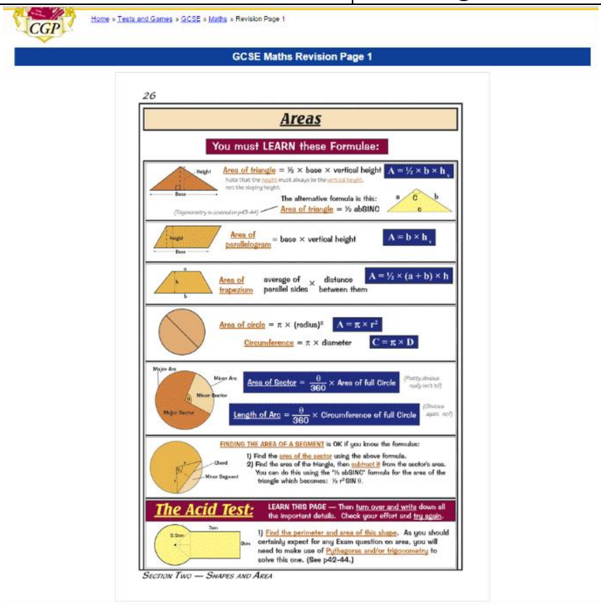
Number

Add subtract mental
Add subtract written
Counting and place value
Calculators
Decimals
Estimating and accuracy
Fractions
Money and finance
Multiply divide mental
Multiply divide written
Percentages
Powers and roots
Ratio and proportion
Standard form

1 Number facts and doubles 1
Knowing pairs that add up to 10. Sums and doubles up to 5.
2 Number facts and doubles 2
3 Number facts and doubles 3
4 Number facts and doubles 4
2 Number bonds
1 Counting on and back
1 Counting on over 10 and 20
2 Sums crossing 10s
2 Sums to 20
3 Add single digits
3 Subtract single digits

Other revision tools that students are most likely to use are revision textbooks that can be uploaded online for them to read on GCP. This is used by students who do not have logins for My Maths and can only navigate websites.

Advantages	Disadvantages
Simple to navigate.	Not fun or memorable.
Learn the exact information needed.	Not the only way people learn.
Clearly laid out.	Only gives correct answers.
Has all areas of maths.	Does not show the level or grade student is working at.



Home » Tests and Games » GCSE » Maths » Revision Page 1

GCSE Maths Revision Page 1

26

Areas

You must LEARN these Formulae:

Area of triangle = ½ × base × vertical height $A = \frac{1}{2} \times b \times h_v$

Note that the height must always be the vertical height, not the sloping height.

The alternative formula is this: Area of triangle = ½ abSINC

(Trigonometry is covered on p43-44)

Area of parallelogram = base × vertical height $A = b \times h_v$

Area of trapezium = average of parallel sides × distance between them $A = \frac{1}{2} \times (a + b) \times h$

Area of circle = π × (radius)² $A = \pi \times r^2$

Circumference = π × diameter $C = \pi \times D$

Area of Sector = $\frac{\theta}{360}$ × Area of full Circle (Pretty obvious really isn't it?)

Length of Arc = $\frac{\theta}{360}$ × Circumference of full Circle (Obvious again, no?)

FINDING THE AREA OF A SEGMENT is OK if you know the formulae:

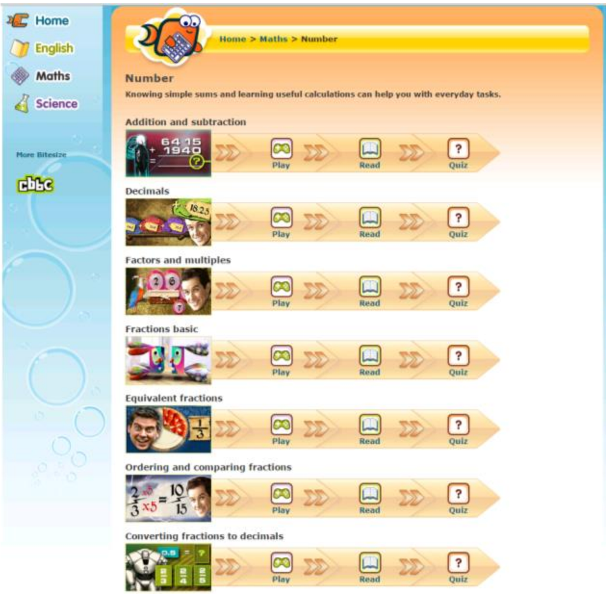
1) Find the area of the sector using the above formula.
2) Find the area of the triangle, then subtract it from the sector's area. You can do this using the "½ abSINC" formula for the area of the triangle which becomes: ½ r²SIN θ.

The Acid Test: LEARN THIS PAGE — Then turn over and write down all the important details. Check your effort and try again.

1) Find the perimeter and area of this shape. As you should certainly expect for any Exam question on area, you will need to make use of Pythagoras and/or trigonometry to solve this one. (See p42-44.)

Section Two — Shapes and Area

Another revision tool that could be used would be BBC Bitesize which is a website that offers games for students to play. This would be used by students who prefer games to reading and would be more visual learners.



Home > Maths > Number

Number

Knowing simple sums and learning useful calculations can help you with everyday tasks.

Addition and subtraction

Decimals

Factors and multiples

Fractions basic

Equivalent fractions

Ordering and comparing fractions

Converting fractions to decimals

From my research I can conclude popular ways of revising maths are not memorable or fun for students to do. The solutions also do not show how to work out the maths or any guidance which students require to learn. Students could also forget logins to specific programs which will hinder their learning.

However there are many advantages of the programs such as the depth in the areas of maths and the simple navigation systems as well as being clearly laid out. Some solutions also teach maths to the students before they attempt the questions as well as different ability levels for students.

All of these programs also require internet access which isn’t always available. Furthermore, My Maths requires a computer as specific questions as a keyboard and mouse are needed.

TETRIS REVISION

Questionnaire

Tetris Revision

1. What sort of questions do students need to revise?

………

………

………

………

………

2. Would a fun game be helpful to revise with? If Yes/No why?

   Yes/No

………

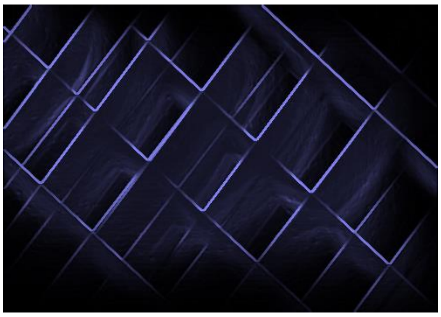
………

………

………

………

3. What would be the best background do you feel to be most suited to students? (1 or 2)



4. Have you used other programmes to help with maths revision before?

……

……

……

……

……

5. What type of hardware is used at the school?

……

……

……

……

……

Questionnaire 2

Tetris Revision

1. What do you find hard about maths?

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

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2. Do you want to be successful in maths? If Yes/No Why?

   Yes/No

………………………………………………………………………………………………………

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………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

3. Is it stressful trying to revise or upcoming tests/exams? If Yes/No Why?

   Yes/No

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

4. What do you feel is the best way to learn?

……

……

……

……

……

5. What sort of computing devices do you have access to at any time?

……

……

……

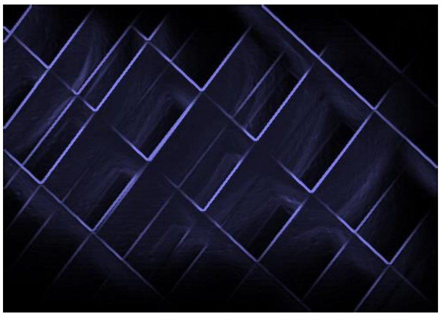
……

……

6. Would you use a programme to help you revise maths skills?

   Yes/No

7. Which colour scheme do you prefer?(1 or 2)



Analysis

From my questionnaire I discovered Tetris revision would be a good idea as it helps for quick numeracy skills for students. I also found out that basic numeracy skills need to be improved so I will have simple maths questions on the program. I also discovered the user would want background 2. I also found out that the user has used maths revision before and has desktop pc.

My second questionnaire was sent to students from my old school at Ormiston Victory Academy. These were aimed to discover the best way for all of them to learn and to see what sort of computing equipment they have at all times so that they could revise at home or at school. From this questionnaire I discovered that students had a constant access to desktop computers. They also felt that they wanted to be more successful in maths and found it difficult to revise as there isn't much to use. Furthermore, they found it stressful at times when they had exams or tests therefore my programme would help them learn the necessary skills to cope with the exams and tests. They also expressed that they needed something to di whilst revising instead of reading it out of a textbook.

Idea

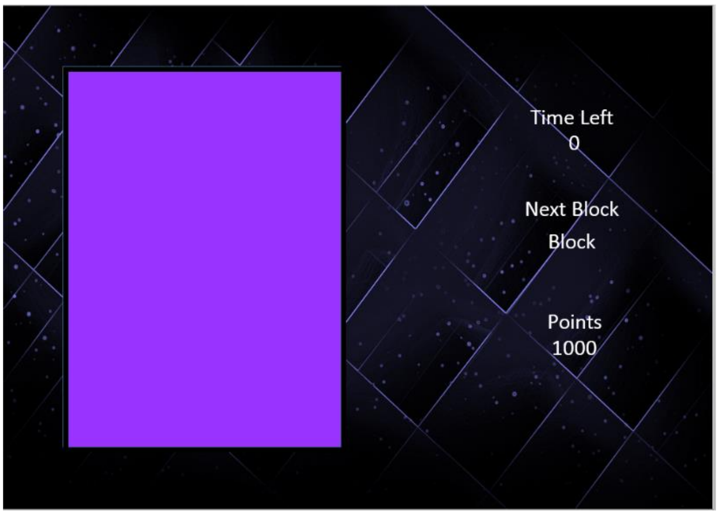
My idea is to create a revision tool for maths involving a fun game such as Tetris. I will code Tetris and add in quick fire easy questions on a timer which will get progressively harder whilst the game of Tetris continues. This will help students feel more focused on maths and will help them during lessons and with reinforced usage it can help their mental maths and simple operations in maths. My program will be used by maths teachers as a starting activity to help students focus on maths even more. Furthermore my program will have a leader board for students to compete to be at the top. This will lead students to compete at the stop and begin to become better at simple maths which will ease them into a lesson of maths in school so that they feel comfortable with learning maths and not stressing about upcoming exams or tests therefore completing my aims and objectives.

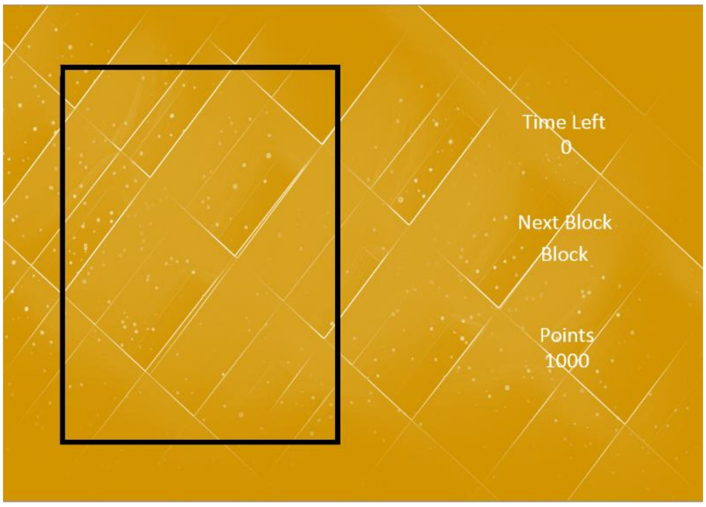
Limitations

There are a few limitations with my program unfortunately as the program will require a mouse and keyboard so it will need to be run on a desktop computer. Furthermore, it will only have simple questions as it is based on being a starting activity. However, this will still serve its purpose to help students into a maths lesson.

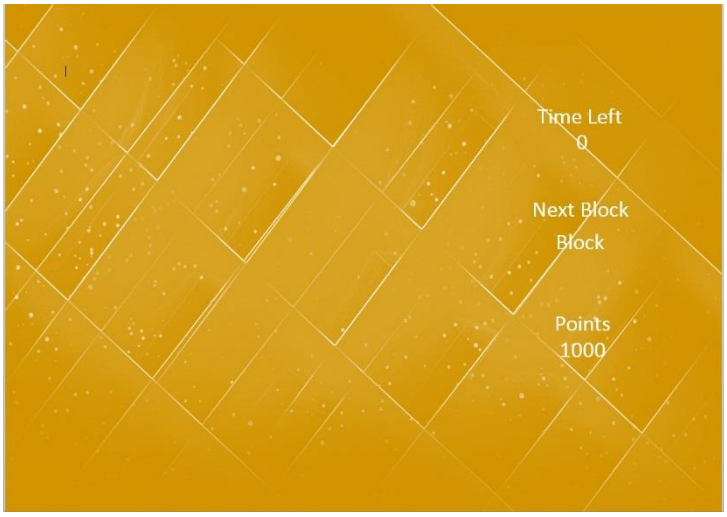
Design

These were the original ideas for my design which revolved around a colour scheme of purple and black or gold and black due to that appealing to all students from my questionnaire.

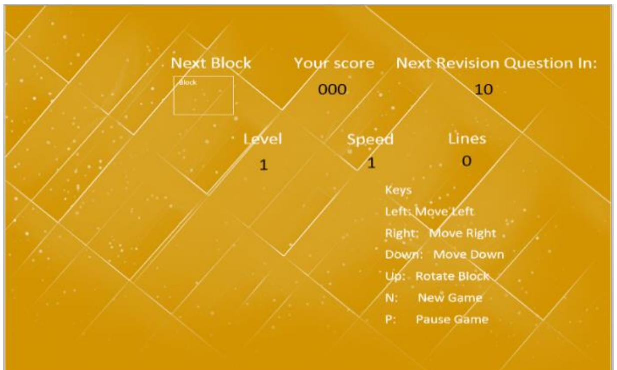




However once I tried this in visual basic I discovered that the black outline for the box that was going to be played in was beeping along with the falling blocks so that it disappeared for a slight second when the blocks fell from the top so I came up with a similar design that did not incorporate this idea.

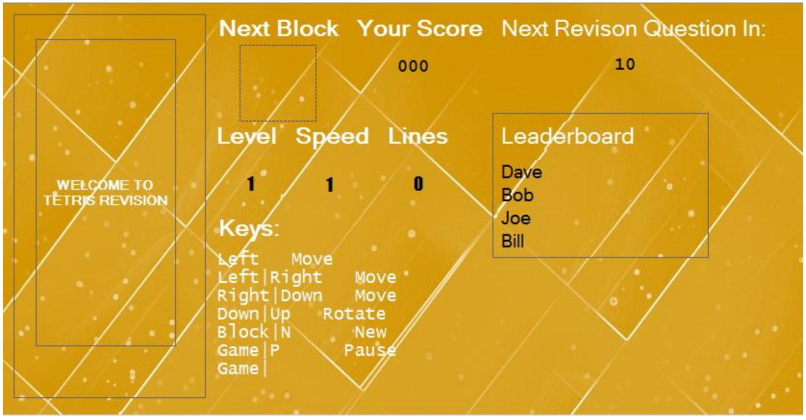


I then decided to add in the controls for my game so that players would not be confused which also lead to a new design as I moved the labels around and renamed time left to “Next Revision Question In:” so that it is easier to understand.



Keys
Left: Move Left
Right: Move Right
Down: Move Down
Up: Rotate Block
N: New Game
P: Pause Game

During my final design I decided to add in a leader board so that students would have fun and compete to have the highest score between their class mates to encourage them to beat each other and then in the process revise maths at the same time. I also added in a message before the game starts to be more user friendly. I changed the text and areas of the labels so that it was clearer and easier to read. I also added in a small outline for the game board so users could see the area they are playing in.



WELCOME TO TETRIS REVISION

Next Block Your Score Next Revison Question In:

000

10

Level Speed Lines

1 1 0

Leaderboard

Dave
Bob
Joe
Bill

Keys:

```
Left    Move
Left|Right    Move
Right|Down    Move
Down|Up    Rotate
Block|N       New
Game|P       Pause
Game|
```

Aims and Objectives

My aims and objectives

Aims: To help students revise maths

Objectives:

- The program must move blocks down.
- The program must have a leader board.
- The program must have a working score counter.
- The program must have blocks that are moved by arrow keys.
- Have students that improve their maths skills from using the program.

My client’s aims and objectives

Aims: To help students pass maths exams

Objectives:

- The program must have maths related questions.
- The program must be able to work on desktop computers.
- The program must be fun for students.

Testing strategies

There are five types of testing and are listed below:

Black box testing

Suitable inputs are tested against the expected output without considering how the program works.

White box testing

The actual steps of the algorithm are tested to make sure all parts work as intended.

Alpha testing

Testing is carried out by the programmer playing the role of the user. This is to find bugs during development.

Beta testing

The nearly complete program is given to a group of users to test. The aim is to find any errors the programmer has overlooked.

Acceptance testing

The program is tested to prove to the end user that it meets the original objectives. This is after development is done.

The testing strategies I'm going to use are all of them due to my program having small inputs for the use of black box testing. I will use white box testing in depth to make sure all of the algorithms work as intended to make the game run smoothly. I will use alpha testing after these are completed to make sure there are not any bugs so the game completed the objectives I have set out. I will next have a group of users test the program to see what they do to the program to see what users are likely to do which will increase the chance of finding bugs and things that need to be adjusted. Finally I will have acceptance testing to prove to the user that the objectives have been met.

Hardware and software requirements

Visual Studio 2015

Visual Studio Community 2015 with Update 2

Supported operating systems

- Windows 10
- Windows 8.1
- Windows 8
- Windows 7 Service Pack 1
- Windows Server 2012 R2
- Windows Server 2012
- Windows Server 2008 R2 SP1

Hardware requirements

- 1.6 GHz or faster processor
- 1 GB of RAM (1.5 GB if running on a virtual machine)
- 4 GB of available hard disk space
- 5400 RPM hard disk drive
- DirectX 9-capable video card that runs at 1024 x 768 or higher display resolution

Additional requirements

- This version of Visual Studio works best with Internet Explorer 10 or later. Some features might not work as expected when it, or a later version, is not installed.
- For Windows Store and Windows Universal app development:
  - Windows 8.1 and Windows Phone 8.1 and development require Windows 8.1 Update or later.
  - Windows Phone 8.0 development requires Windows 8.1 Update (x64) or later.
  - For emulator support (Windows or Android), Windows 8.1 (x64) Professional edition or later or Windows 10 Pro or Enterprise (x64) editions are required. A processor that supports Client Hyper-V and Second Level Address Translation (SLAT) is also required.

Component list

Component	Name	Use
Label	Message Label	This label has the message welcoming students which they have to click onto so they can continue with the program.
Picture Box	GameBox	This picture box has the game playing in.
Label	HelpLabel	This label contains necessary information on how to play the game.
Label	Title_for_keys	Shows where the information of how to play the game are.
Label	LevelLabel	The number of what the level the player is on.
Label	SpeedLabel	The speed of the blocks are falling.
Label	LinesLabel	The amount of lines the player has completed.
Label	Title_for_level	Title for Level
Label	Title_for_speed	Title for Speed
Label	Title_for_lines	Label for Lines
Picture Box	PreviewBox	The area that shows the preview message.
Label	Title_for_nextblock	Next Block title
Label	Label_score	The score which has 100 points added per line the player completes.
Label	Title_for_score	This label has Your score written in it to show the player where their score is.
Label	Revision_Label	Title for revision timer
Label	Time_label	This label shows the time until the next revision question.
List Box	Leaderboard	This list box is to be used for the scoreboard that will contain players' scores in order.
MsgBox	Top_ Msg	The label for the user with the most score.
MsgBox	Second_ Msg	The label for the user with the 2nd highest score.
MsgBox	Third_ Msg	The label for the user with the 3rd highest score.
MsgBox	Fourth_ Msg	The label for the user with the 4th highest score.

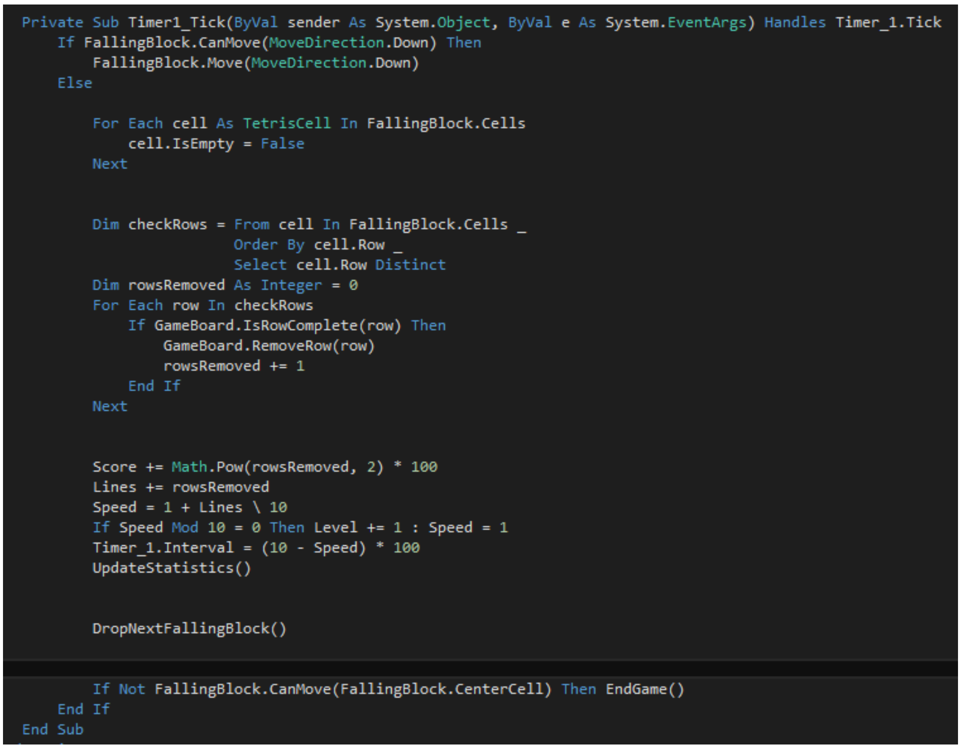
Variable List

Variable	Name	Use
Private	GameBoard	This is the game board that is imported so that players can use this to play on my programme.
Private	FallingBlock	This is imported code that causes the blocks to fall for the programme.
Private	PreviewBoard	This is the board that is shown before the game board so that players can see the high scores.
Private	PreviewBlock	This is used for showing the next block that the player is going to use.
String	Playername	Used to store players name for when they play the game.
String	Scores	Used to store the score the player got which will be displayed on the scoreboard.
Double	Score	The score the user gets saved as double due to more than one line being scored at a time it therefore doubles.
Integer	Level	The amount of levels the user has completed.

Integer	Speed	The speed the user is currently playing at depending on the score they have.
Integer	Lines	The amount of lines the user has completed is shown to them.
Random	RandomNumbers	This variable is used to create a random number of blocks that then decide what block will fall next.
GameStatus	Status	To stop the game when needed so that users can pause the game as well as the programme can then read what lines have been completed.
Enum	Running	This is used for the programme so that it can run after stopping or being paused as well as being able to run after the preview board is gone.
Enum	Paused	This is used to pause the game using game status so that the programme can be paused for users to stop for any reason but want to play on.
Enum	Stopped	This is used to stop the game using game status so that the programme can check the lines that are completed and also check other pieces of the code.
Integer	Len	This is the length of the name for the scoreboard to recognise so that the name is stored properly.
Integer	pos	This is the position of the players score in the scoreboard depending on what they scored.
String	Textline	This is used to write the new text line of code that will be saved as the new scores on the scoreboard.
StreamReader	objrReader	This is used to read the current text file to make sure it is correct and will save correctly for when the programme re-loads.
File	Count	This is used to make sure the text file that is saved has a top five in the order of highest score to lowest score.
Integer	Checkrows	This checks each row for the correct number of blocks in a row so that it can be saved as the number of the rows that have been removed.
Integer	rowsRemoved	This is used to tell the user how many lines they have completed in my programme.
Integer	Number	This is used to select how many individual blocks the new block has.
String	newpos(5)	This is used to save the new position of the player that just finished with their score so that the list box for the leader board can be edited.
Integer	temp	This is used for the revision timer so that it starts at 10 seconds then ticks down until 0.
String	message	This is used to display the revision questions with a pop up box.
String	title	This is the title of the pop up box for the revision questions.
Integer	answer	This is used for the answer to the revision question in which it can only be one answer so that the revision question has to be answered correctly to continue.
Integer	Num	This is used to be the first number for the revision question that is randomised.
Integer	num2	This is used to be the second number for the revision question that is randomised.
Integer	correct	This is used to have the correct answer saved so the programme can check the answer with the answer the user has answered with.

Integer	optype	This is used for the type of operation that the question is asking so that only three operations can be used.

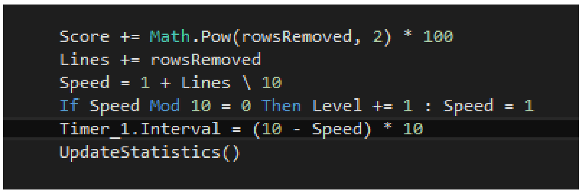
Code Development



```
Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Timer_1.Tick
    If FallingBlock.CanMove(MoveDirection.Down) Then
        FallingBlock.Move(MoveDirection.Down)
    Else

        For Each cell As TetrisCell In FallingBlock.Cells
            cell.IsEmpty = False
        Next


        Dim checkRows = From cell In FallingBlock.Cells _
                        Order By cell.Row _
                        Select cell.Row Distinct
        Dim rowsRemoved As Integer = 0
        For Each row In checkRows
            If GameBoard.IsRowComplete(row) Then
                GameBoard.RemoveRow(row)
                rowsRemoved += 1
            End If
        Next


        Score += Math.Pow(rowsRemoved, 2) * 100
        Lines += rowsRemoved
        Speed = 1 + Lines \ 10
        If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
        Timer_1.Interval = (10 - Speed) * 100
        UpdateStatistics()


        DropNextFallingBlock()


        If Not FallingBlock.CanMove(FallingBlock.CenterCell) Then EndGame()
    End If
End Sub
```

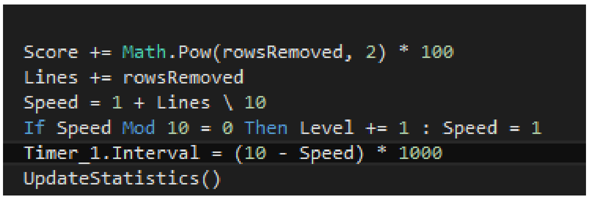
This is a piece of code from my programme that was difficult to code as I needed to create something that would check the rows to see if they were completed and then would add onto the score of the player. Then continue onto drop the next block or stop the game if the player could not continue. I was testing the speed of the falling blocks by changing the value of the multiplier to the speed.

I started by changing the multiplier to 1000 instead of 100 however this caused the block to lower every 10 seconds which was too slow as the game is supposed to be quick and enjoyable.



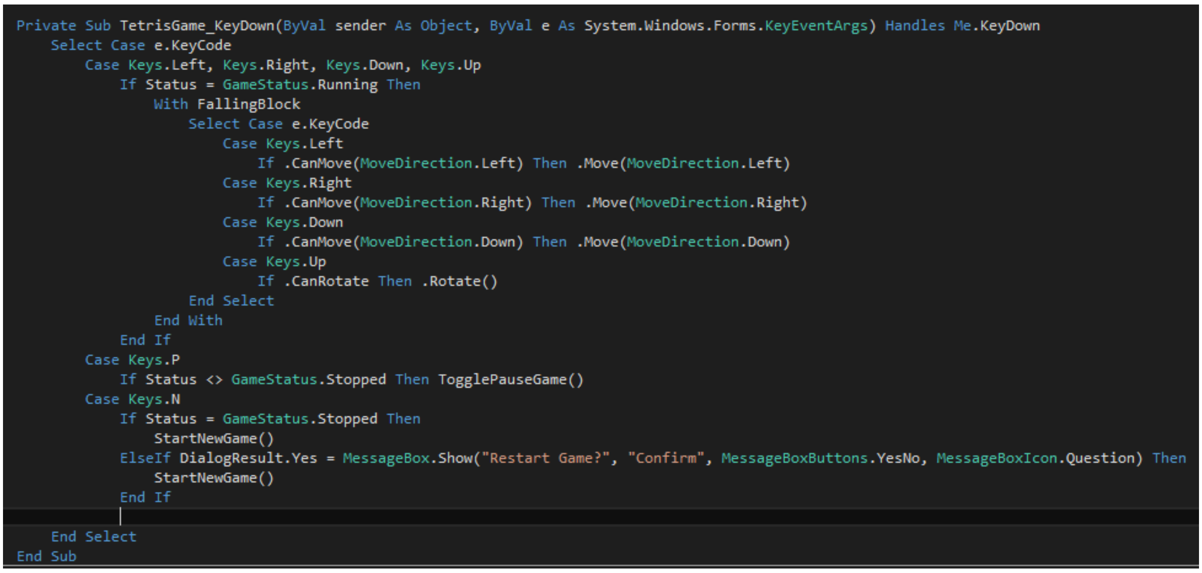
```
Score += Math.Pow(rowsRemoved, 2) * 100
Lines += rowsRemoved
Speed = 1 + Lines \ 10
If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
Timer_1.Interval = (10 - Speed) * 10
UpdateStatistics()
```

I then changed the multiplier to 10 however this was too fast as the player could not get the block over to the side before it hit the bottom and they did not have enough time to rotate the block to the correct rotation.



```
Score += Math.Pow(rowsRemoved, 2) * 100
Lines += rowsRemoved
Speed = 1 + Lines \ 10
If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
Timer_1.Interval = (10 - Speed) * 1000
UpdateStatistics()
```

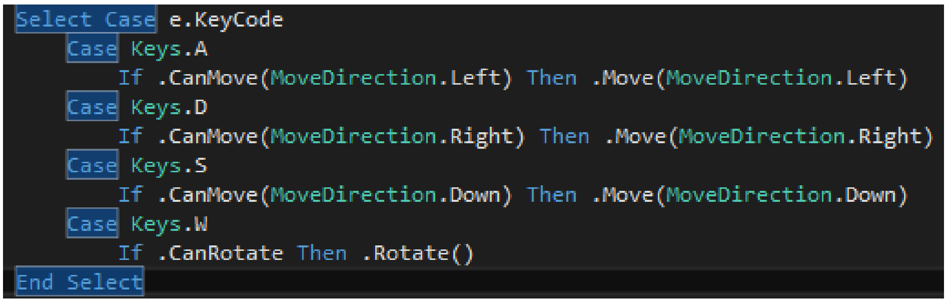
Therefore it was kept at 100 as this was the optimum speed for the blocks to fall as this was more enjoyable for the player and could be properly used.



```
Private Sub TetrisGame_KeyDown(ByVal sender As Object, ByVal e As System.Windows.Forms.KeyEventArgs) Handles Me.KeyDown
    Select Case e.KeyCode
        Case Keys.Left, Keys.Right, Keys.Down, Keys.Up
            If Status = GameStatus.Running Then
                With FallingBlock
                    Select Case e.KeyCode
                        Case Keys.Left
                            If .CanMove(MoveDirection.Left) Then .Move(MoveDirection.Left)
                        Case Keys.Right
                            If .CanMove(MoveDirection.Right) Then .Move(MoveDirection.Right)
                        Case Keys.Down
                            If .CanMove(MoveDirection.Down) Then .Move(MoveDirection.Down)
                        Case Keys.Up
                            If .CanRotate Then .Rotate()
                    End Select
                End With
            End If
        Case Keys.P
            If Status <> GameStatus.Stopped Then TogglePauseGame()
        Case Keys.N
            If Status = GameStatus.Stopped Then
                StartNewGame()
            ElseIf DialogResult.Yes = MessageBox.Show("Restart Game?", "Confirm", MessageBoxButtons.YesNo, MessageBoxIcon.Question) Then
                StartNewGame()
            End If

    End Select
End Sub
```

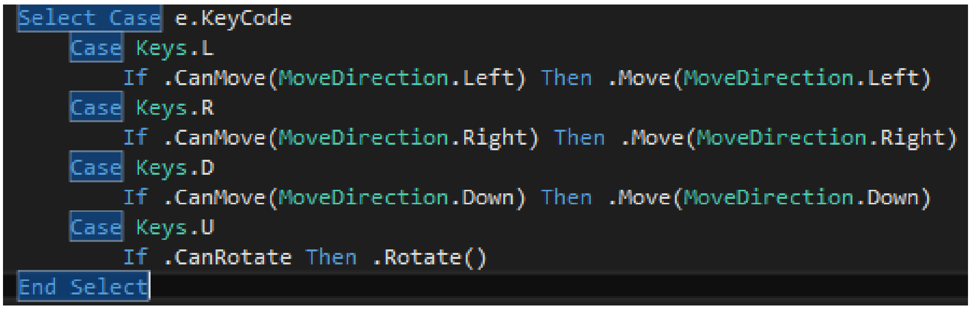
This is the piece of code for the user to be able to move the blocks. I had to decide to use either wasd, or the arrow keys to move the blocks around. I decided as some users may not have used pc games as much as others that the simpler option of the arrow keys would be more suitable.

I tried the arrow keys for a short time however I found that it was much more difficult for users who were not as good with wasd and felt more comfortable using the arrow keys. Furthermore, users preferred using their right hand for the movement of the blocks so that they could answer questions with the numbers above the letters.

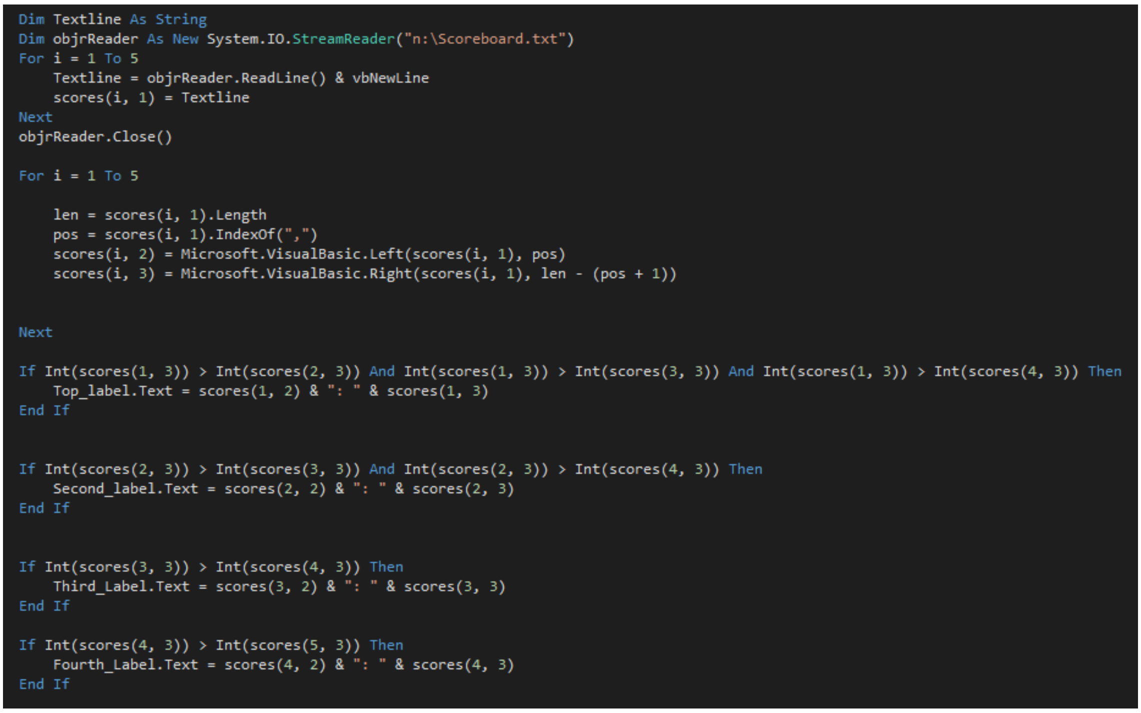


```
Select Case e.KeyCode
    Case Keys.A
        If .CanMove(MoveDirection.Left) Then .Move(MoveDirection.Left)
    Case Keys.D
        If .CanMove(MoveDirection.Right) Then .Move(MoveDirection.Right)
    Case Keys.S
        If .CanMove(MoveDirection.Down) Then .Move(MoveDirection.Down)
    Case Keys.W
        If .CanRotate Then .Rotate()
End Select
```

I also tried other combinations of keys but however decided not to use them as these are not commonly known. I decided to use U (Up) D (Down) L (Left) R (Right). Furthermore this was uncomfortable for users to have as their hand would be constantly moving.



```
Select Case e.KeyCode
    Case Keys.L
        If .CanMove(MoveDirection.Left) Then .Move(MoveDirection.Left)
    Case Keys.R
        If .CanMove(MoveDirection.Right) Then .Move(MoveDirection.Right)
    Case Keys.D
        If .CanMove(MoveDirection.Down) Then .Move(MoveDirection.Down)
    Case Keys.U
        If .CanRotate Then .Rotate()
End Select
```



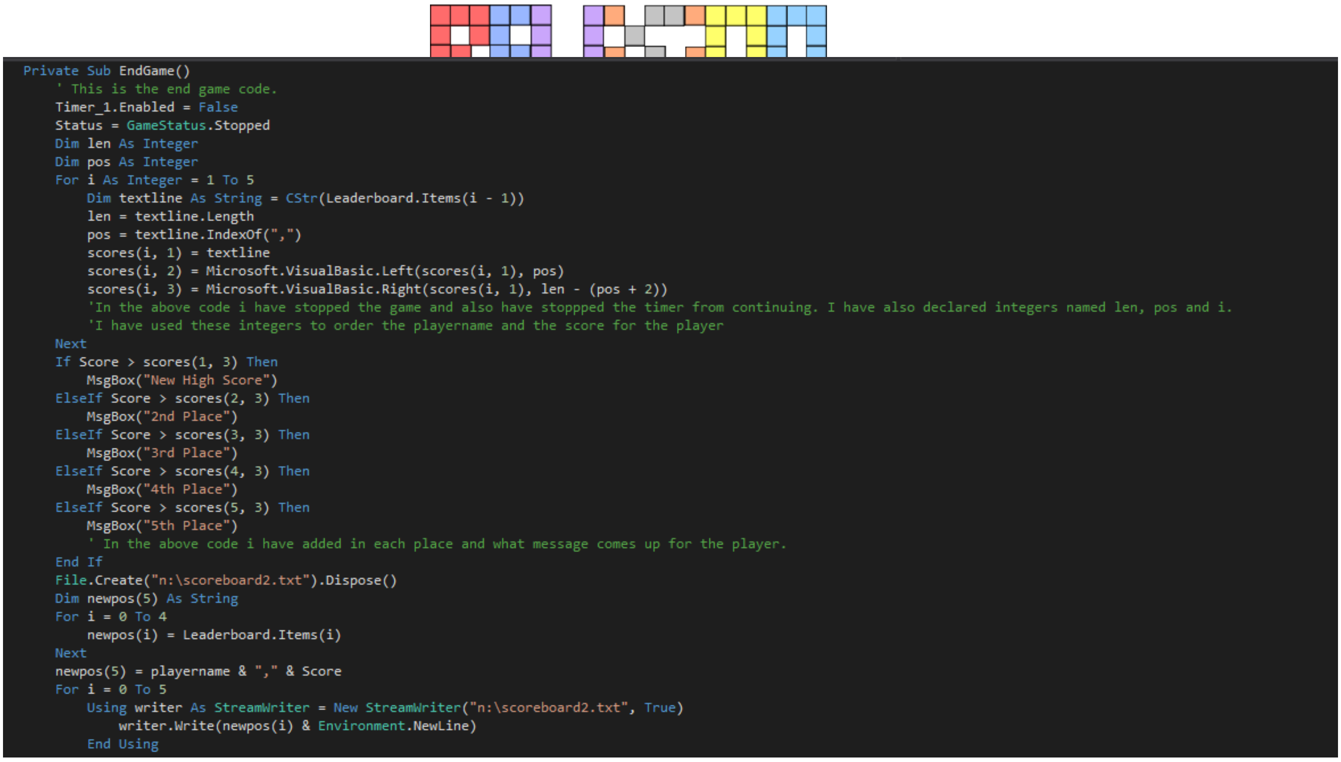
```
Dim Textline As String
Dim objrReader As New System.IO.StreamReader("n:\Scoreboard.txt")
For i = 1 To 5
    Textline = objrReader.ReadLine() & vbNewLine
    scores(i, 1) = Textline
Next
objrReader.Close()

For i = 1 To 5

    len = scores(i, 1).Length
    pos = scores(i, 1).IndexOf(",")
    scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
    scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos + 1))


Next

If Int(scores(1, 3)) > Int(scores(2, 3)) And Int(scores(1, 3)) > Int(scores(3, 3)) And Int(scores(1, 3)) > Int(scores(4, 3)) Then
    Top_label.Text = scores(1, 2) & ": " & scores(1, 3)
End If


If Int(scores(2, 3)) > Int(scores(3, 3)) And Int(scores(2, 3)) > Int(scores(4, 3)) Then
    Second_label.Text = scores(2, 2) & ": " & scores(2, 3)
End If


If Int(scores(3, 3)) > Int(scores(4, 3)) Then
    Third_Label.Text = scores(3, 2) & ": " & scores(3, 3)
End If

If Int(scores(4, 3)) > Int(scores(5, 3)) Then
    Fourth_Label.Text = scores(4, 2) & ": " & scores(4, 3)
End If
```

This code is for my leader board for my users to compete with each other and improve their skills in maths. I stored users' scores and names onto a notepad file that was accessed by the object reader. I found it was difficult to code the object reader to read all of the users' names and scores and then list them that way as it required more code than any other part of my programme.

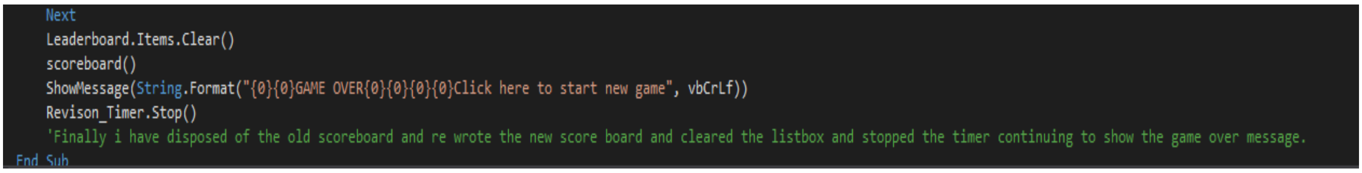
I reworked this piece of code completely which has made the leader board much better at recording scores and names and showing the top 5 players. However I soon found a problem with this code in which it would not work. This was because the name and score was saved on the same line as another and could not be read correctly from the file.

Therefore I have completely changed the code to work without having the same problem occur again. During this time I encountered many problems which caused the code not to work. Below is the final code with comments added in about the leader board.

In the below code the leader board saves the scores and users names to a new file then deletes the older file so that it has only the new scores. The new file is then read once the programme starts again and repeats. Once the programme saves the scores one of the messages will appear saying new high score, 2nd place, 3rd place, 4th place or 5th place. Once the game is completed the game over sign is shown and the game can start again.

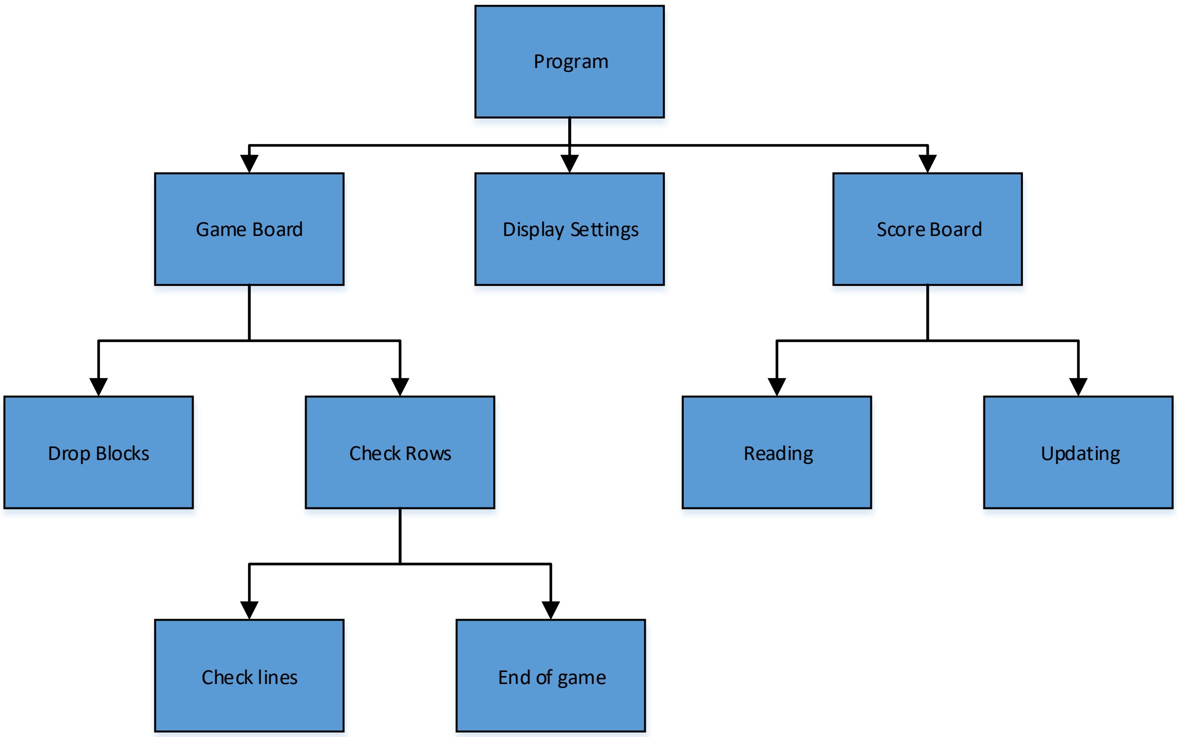


```
Private Sub EndGame()
    ' This is the end game code.
    Timer_1.Enabled = False
    Status = GameStatus.Stopped
    Dim len As Integer
    Dim pos As Integer
    For i As Integer = 1 To 5
        Dim textline As String = CStr(Leaderboard.Items(i - 1))
        len = textline.Length
        pos = textline.IndexOf(",")
        scores(i, 1) = textline
        scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
        scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos + 2))
        'In the above code i have stopped the game and also have stoppped the timer from continuing. I have also declared integers named len, pos and i.
        'I have used these integers to order the playername and the score for the player
    Next
    If Score > scores(1, 3) Then
        MsgBox("New High Score")
    ElseIf Score > scores(2, 3) Then
        MsgBox("2nd Place")
    ElseIf Score > scores(3, 3) Then
        MsgBox("3rd Place")
    ElseIf Score > scores(4, 3) Then
        MsgBox("4th Place")
    ElseIf Score > scores(5, 3) Then
        MsgBox("5th Place")
        ' In the above code i have added in each place and what message comes up for the player.
    End If
    File.Create("n:\scoreboard2.txt").Dispose()
    Dim newpos(5) As String
    For i = 0 To 4
        newpos(i) = Leaderboard.Items(i)
    Next
    newpos(5) = playername & "," & Score
    For i = 0 To 5
        Using writer As StreamWriter = New StreamWriter("n:\scoreboard2.txt", True)
            writer.Write(newpos(i) & Environment.NewLine)
        End Using
```



```
    Next
    Leaderboard.Items.Clear()
    scoreboard()
    ShowMessage(String.Format("{0}{0}GAME OVER{0}{0}{0}{0}Click here to start new game", vbCrLf))
    Revison_Timer.Stop()
    'Finally i have disposed of the old scoreboard and re wrote the new score board and cleared the listbox and stopped the timer continuing to show the game over message.
End Sub
```

Structure Diagram



The above diagram is the structure of how my program works and what parts it is made up of.

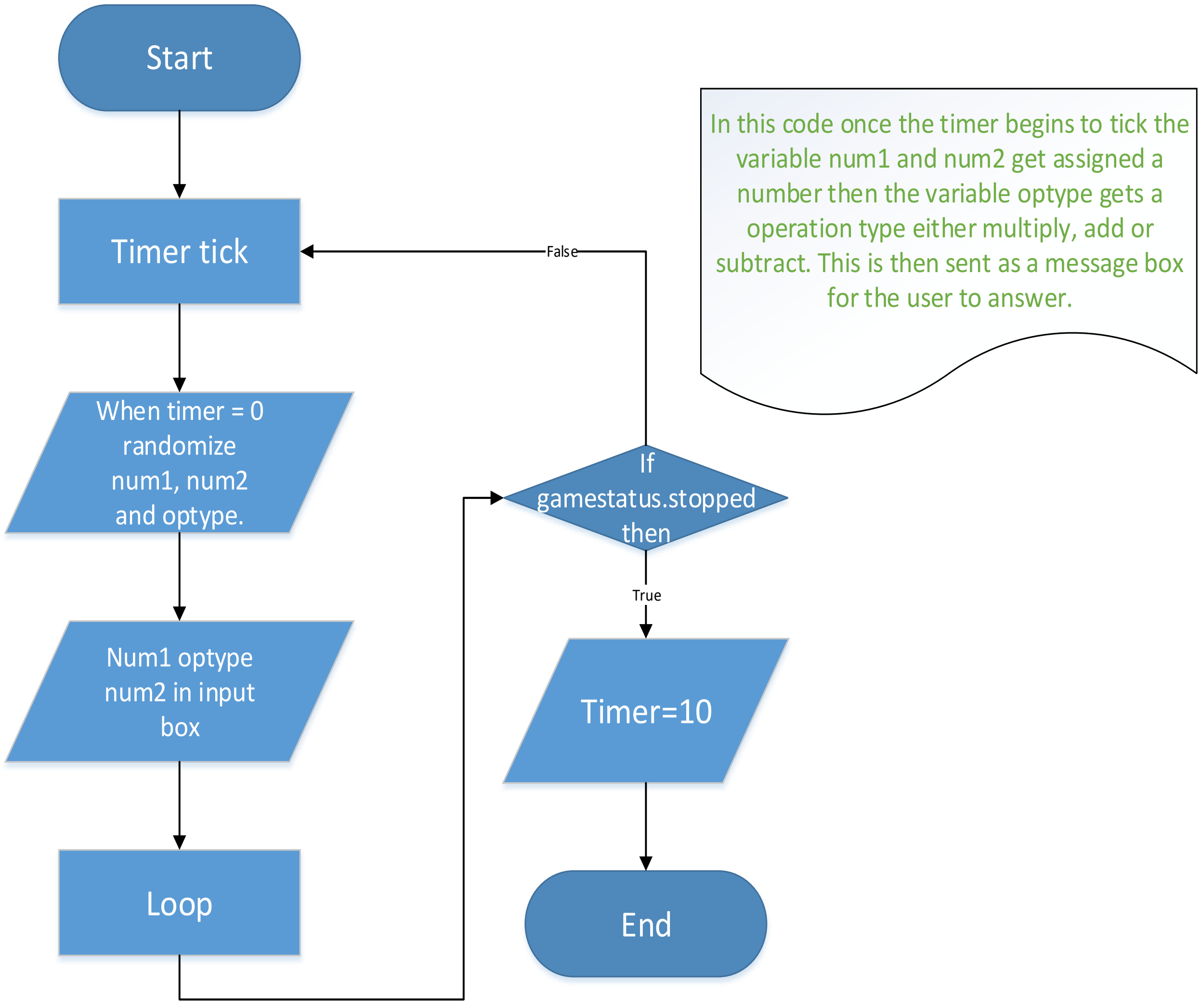
Annotated code

```
Imports MyGames.Tetris
Imports MyGames.Tetris.TetrisBlock
Imports System.Reflection
Imports System.IO
Partial Class TetrisGame
    Private GameBoard As TetrisBoard
    Private FallingBlock As TetrisBlock
    Private PreviewBoard As TetrisBoard
    Private PreviewBlock As TetrisBlock
    Dim playername As String
    Dim scores(11, 3) As String
    Private Score As Double
    Private Level As Integer
    Private Speed As Integer
    Private Lines As Integer
    Private RandomNumbers As New Random
    Private Status As GameStatus = GameStatus.Stopped
    Private Enum GameStatus
        Running
        Paused
        Stopped
    End Enum
#Region "Event Handlers"
    'This is the event handlers code
    Private Sub TetrisGame_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        PreviewBoard = New TetrisBoard(PreviewBox_1)
        With PreviewBoard
            .Rows = 4
            .Columns = 4
            .CellSize = New Size(20, 20)
            .Style = BorderStyle.FixedSingle
            .SetupBoard()
        End With
        PreviewBlock = New TetrisBlock(PreviewBoard)
        PreviewBlock.CenterCell = PreviewBoard.Cells(2, 2)
        PreviewBlock.Shape = GetRandomShape()
        GameBoard = New TetrisBoard(GameBox)
        With GameBoard
            .Rows = 20
            .Columns = 10
            .CellSize = New Size(20, 20)
            .Style = BorderStyle.FixedSingle
            .SetupBoard()
        End With
        'In the above code the preview board is loaded in as well as the size of the
game board
        FallingBlock = New TetrisBlock(GameBoard)
        HelpLabel.Text = HelpLabel.Text.Replace("|", vbCrLf)
        ShowMessage(String.Format("{0}W E L C O M E{0}{0}T O{0}{0}T E T R I
S{0}{0}{0}{0}R E V I S I O N{0}{0}{0}{0}Click here to start new game", vbCrLf))
        playername = InputBox("Please enter your name: ")
        scoreboard()
        'In the above code the falling block view is added in as well as the welcome
to tetris revision message is in
    End Sub
    Sub scoreboard()
        ' This is the scoreboard code
        Dim len As Integer
        Dim pos As Integer
        Dim Textline As String
        Dim objrReader As New System.IO.StreamReader("n:\Scoreboard2.txt")
        Dim count = File.ReadAllLines("n:\Scoreboard2.txt").Length
        Leaderboard.Items.Clear()
        For i = 1 To count
            Textline = objrReader.ReadLine() & vbNewLine
            scores(i, 1) = Textline
        Next
        objrReader.Close()
        For i = 1 To count
            len = scores(i, 1).Length
            pos = scores(i, 1).IndexOf(",")
            If pos = -1 Then
                scores(i, 1) = "xxxx,000"
                scores(i, 2) = "xxxx"
                scores(i, 3) = "000"
            Else
                scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
                scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos +
1))
            End If
            ' In the above code the code reads the scoreboard textfile
        Next
        Dim high As Integer = 0
        For i = 1 To count
            If scores(i, 3) > high Then
                high = scores(i, 3)
            End If
        Next
        For x = high To 0 Step -100
            For i = 1 To count
                If scores(i, 3) > 0 Then
                    If scores(i, 3) = x Then
                        Leaderboard.Items.Add(scores(i, 2) & "," & scores(i, 3))
                    End If
                End If
            Next
        Next
        Leaderboard.Enabled = False
        ' In the above code the users name and scores are added to the listbox to show
the user the scoreboard
    End Sub
    Private Sub TetrisGame_KeyDown(ByVal sender As Object, ByVal e As
System.Windows.Forms.KeyEventArgs) Handles Me.KeyDown
        'In the below code the movement for the blocks is created with the pause
button and a reset for the game
        Select Case e.KeyCode
            Case Keys.Left, Keys.Right, Keys.Down, Keys.Up
                If Status = GameStatus.Running Then
                    With FallingBlock
                        Select Case e.KeyCode
                            Case Keys.Left
                                If .CanMove(MoveDirection.Left) Then
.Move(MoveDirection.Left)
                            Case Keys.Right
                                If .CanMove(MoveDirection.Right) Then
.Move(MoveDirection.Right)
                            Case Keys.Down
                                If .CanMove(MoveDirection.Down) Then
.Move(MoveDirection.Down)
                            Case Keys.Up
                                If .CanRotate Then .Rotate()
                        End Select
                    End With
                End If
            Case Keys.P
                If Status <> GameStatus.Stopped Then TogglePauseGame()
            Case Keys.N
                If Status = GameStatus.Stopped Then
                    StartNewGame()
                ElseIf DialogResult.Yes = MessageBox.Show("Restart Game?", "Confirm",
MessageBoxButtons.YesNo, MessageBoxIcon.Question) Then
                    StartNewGame()
                End If
        End Select
    End Sub
    Private Sub MessageLabel_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MessageLabel.Click
        Revison_Timer.Enabled = True
        Select Case Status
            Case GameStatus.Stopped
                StartNewGame()
            Case GameStatus.Paused
                TogglePauseGame()
        End Select
        ' In the above code the revision timer is set when the game restarts and is
stopped when the game is paused
    End Sub
    Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Timer_1.Tick
        'In the below code the blocks fall and when the rows are completed it updates
the gameboard so that the lines are completed and then disappear
        If FallingBlock.CanMove(MoveDirection.Down) Then
            FallingBlock.Move(MoveDirection.Down)
        Else
            For Each cell As TetrisCell In FallingBlock.Cells
                cell.IsEmpty = False
            Next
            Dim checkRows = From cell In FallingBlock.Cells _
                            Order By cell.Row _
                            Select cell.Row Distinct
            Dim rowsRemoved As Integer = 0
            For Each row In checkRows
                If GameBoard.IsRowComplete(row) Then
                    GameBoard.RemoveRow(row)
                    rowsRemoved += 1
                End If
                ' In the below code the maths is daaded in so that the score is
updated and the speed can change depending on how well the player is doing
            Next
            Score += Math.Pow(rowsRemoved, 2) * 100
            Lines += rowsRemoved
            Speed = 1 + Lines \ 10
            If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
            Timer_1.Interval = (10 - Speed) * 100
            UpdateStatistics()
            DropNextFallingBlock()
            If Not FallingBlock.CanMove(FallingBlock.CenterCell) Then EndGame()
        End If
    End Sub
#End Region
#Region "Private Methods"
    Private Function GetRandomShape() As TetrisBlock.Shapes
        Dim number As Integer = RandomNumbers.Next(Shapes.I1, Shapes.Z4 + 1)
        Return CType(number, TetrisBlock.Shapes)
    End Function
    Private Sub DropNextFallingBlock()
        ' In the below code the next block is falling as the preview block refeshes 
and the block is dropped
        FallingBlock.CenterCell = GameBoard.Cells(2, GameBoard.Columns \ 2)
        FallingBlock.Shape = PreviewBlock.Shape
        PreviewBlock.Shape = GetRandomShape()
        PreviewBlock.RefreshBackGround()
        PreviewBlock.Refresh()
    End Sub
    Private Sub StartNewGame()
        'In the below code the game has started again and the statistics have been re-
set
        Score = 0
        Lines = 0
        Speed = 1
        Level = 1
        Timer_1.Interval = 1000
        UpdateStatistics()
        Time_Label.Text = 10
        GameBoard.SetupBoard()
        DropNextFallingBlock()
        MessageLabel.Visible = False
        Timer_1.Enabled = True
        Status = GameStatus.Running
    End Sub
    Private Sub EndGame()
        ' This is the end game code.
        Timer_1.Enabled = False
        Status = GameStatus.Stopped
        Dim len As Integer
        Dim pos As Integer
        For i As Integer = 1 To 5
            Dim textline As String = CStr(Leaderboard.Items(i - 1))
            len = textline.Length
            pos = textline.IndexOf(",")
            scores(i, 1) = textline
            scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
            scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos + 2))
            'In the above code i have stopped the game and also have stoppped the 
timer from continuing. I have also declared integers named len, pos and i. I have used 
these integers to order the playername and the score for the player
        Next
        If Score > scores(1, 3) Then
            MsgBox("New High Score")
        ElseIf Score > scores(2, 3) Then
            MsgBox("2nd Place")
        ElseIf Score > scores(3, 3) Then
            MsgBox("3rd Place")
        ElseIf Score > scores(4, 3) Then
            MsgBox("4th Place")
        ElseIf Score > scores(5, 3) Then
            MsgBox("5th Place")
            ' In the above code i have added in each place and what message comes up 
for the player.
        End If
        File.Create("n:\scoreboard2.txt").Dispose()
        Dim newpos(5) As String
        For i = 0 To 4
            newpos(i) = Leaderboard.Items(i)
        Next
        newpos(5) = playername & "," & Score
        For i = 0 To 5
            Using writer As StreamWriter = New StreamWriter("n:\scoreboard2.txt",
True)
                writer.Write(newpos(i) & Environment.NewLine)
            End Using
        Next
        Leaderboard.Items.Clear()
        scoreboard()
        ShowMessage(String.Format("{0}{0}GAME OVER{0}{0}{0}{0}Click here to start new
game", vbCrLf))
        Revison_Timer.Stop()
        'Finally i have disposed of the old scoreboard and re wrote the new score
board and cleared the listbox and stopped the timer continuing to show the game over
message.
    End Sub
    Private Sub UpdateStatistics()
        Label_score.Text = Score.ToString("000")
        LinesLabel.Text = Lines.ToString
        LevelLabel.Text = Level.ToString
        SpeedLabel.Text = Speed.ToString
        'In the above code the statistics have been updated so that when the programme
starts the statistics are changed.
    End Sub
    Private Sub TogglePauseGame()
        'In the below code when the game is paused by the user the timer stops and the
the game stops running.
        If Status = GameStatus.Paused Then
            Status = GameStatus.Running
            MessageLabel.Visible = False
            Timer_1.Enabled = True
            Revison_Timer.Start()
        Else
            Status = GameStatus.Paused
            ShowMessage(String.Format("{0}{0}GAME PAUSED{0}{0}{0}{0}Click here to
resume.", vbCrLf))
            Revison_Timer.Stop()
        End If
    End Sub
    Private Sub ShowMessage(ByVal message As String)
        'In the below code the timer is stopped and a message is sent to the user
        MessageLabel.Text = message
        MessageLabel.Visible = True
        Timer_1.Enabled = False
    End Sub
#End Region
    Private Sub Revison_Timer_Tick(sender As Object, e As EventArgs) Handles
Revison_Timer.Tick
        Dim temp As Integer = Time_Label.Text
        If temp > 0 Then
            Time_Label.Text = temp - 1
        End If
        If temp = 0 Then
            Revison_Timer.Stop()
            Dim message, title As String
            Dim answer As Integer = 0
            Dim num As Integer
            Dim num2 As Integer
            Dim correct As Integer = 1000
            Dim optype As Integer
            Randomize()
            num = Int(Rnd() * 12) + 1
            Randomize()
            num2 = Int(Rnd() * 12) + 1
            Randomize()
            optype = Int(Rnd() * 3) + 1
            If optype = 1 Then
                message = num & " + " & num2
                correct = num + num2
            ElseIf optype = 2 Then
                message = num & " - " & num2
                correct = num - num2
            Else
                message = num & " x " & num2
                correct = num * num2
            End If
            title = "Tetris Revision"
            Do While answer <> correct
                answer = InputBox(message, title)
            Loop
            If Status = GameStatus.Stopped Then
            Else
                Time_Label.Text = 10
                Revison_Timer.Start()
                'In the above code the revision timer is stopped and two random
numbers are generated with three potential operations for the user to complete before
they can continue with the game
            End If
        End If
    End Sub
End Class
```

Flowcharts and Pseudo Code

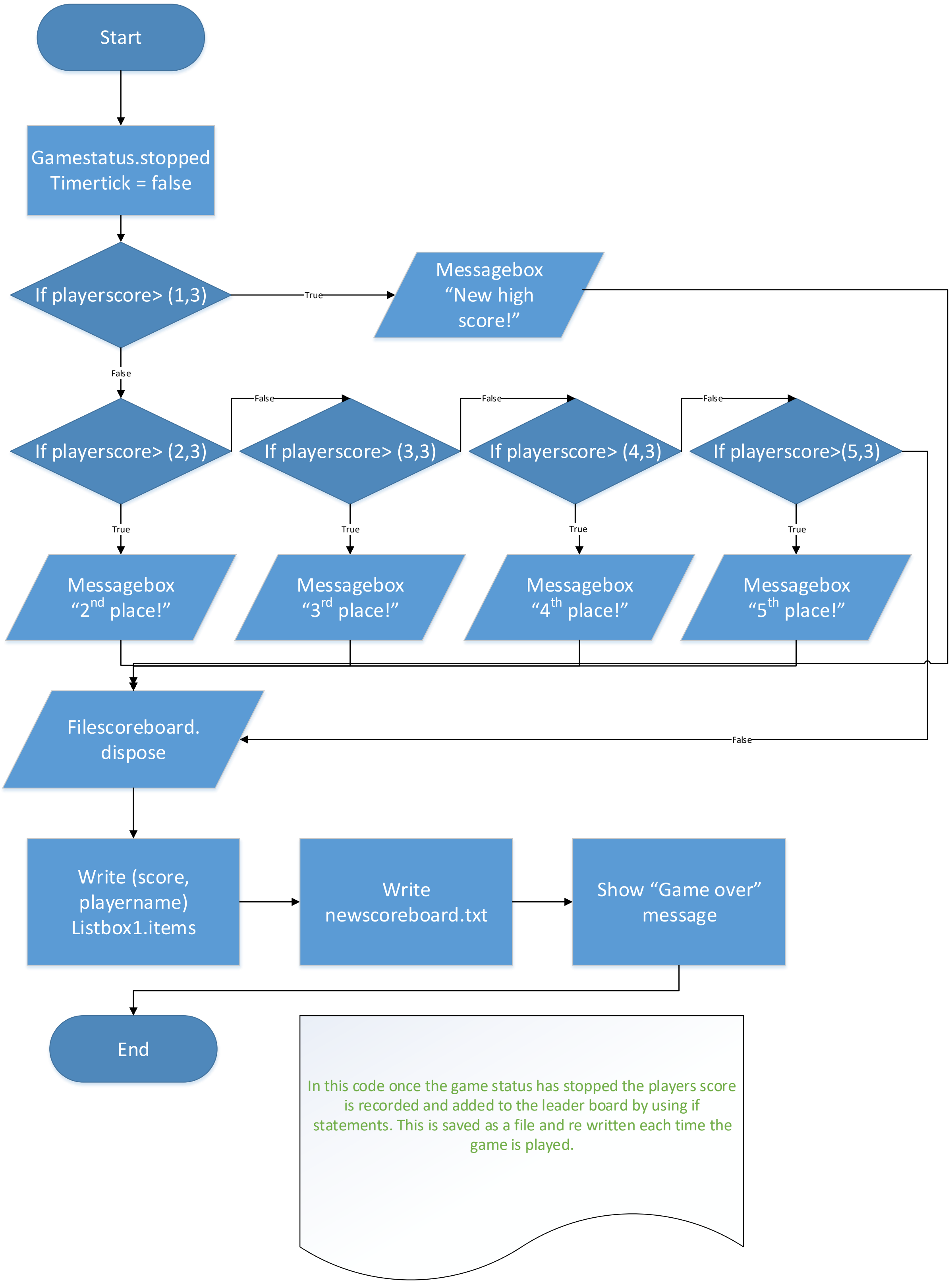
Flowchart of revision timer

The below flowchart shows how the timer will change and how the numbers will be generated with the correct operation type. Then this will restart until the game is stopped.


Start
Timer tick
When timer = 0 randomize num1, num2 and optype.
Num1 optype num2 in input box
Loop
If gamestatus.stopped then
False
True
Timer=10
End
In this code once the timer begins to tick the variable num1 and num2 get assigned a number then the variable optype gets a operation type either multiply, add or subtract. This is then sent as a message box for the user to answer.

Flowchart of scoring system

The below flowchart shows how the game will save the score of players and then will corresponding to the score show which message is required either for a new high score or not. This will be once the game has stopped.



In this code once the game status has stopped the players score is recorded and added to the leader board by using if statements. This is saved as a file and re written each time the game is played.

Pseudo code for loading scoreboard and checking each row for blocks and complete lines

Pseudo code of the scoreboard saving scores

The below pseudo code shows how the scoreboard will be applied to the program. It will save the score of the player by counting the number of lines the player has completed as well as adding the score to the list box which is the scoreboard.

```
START
    LOAD scoreboard.txt
    FOR I = 1 to numberoflines
        Scores(i) = readline
    NEXT
    CLOSE scoreboard.txt
    FOR I = 1 to numberoflines
        IF scores(i) = “” THEN
            Scores(i) = “xxx”
        ENDIF                // In the above code the scoreboard reads how many lines are completed and below it saves the score and puts the score and name onto the leader board which is a list box.
    NEXT
    High = 0
    FOR I = 1 to numberoflines
        IF scores(i) > high then
            High = scores(i)
        ENDIF
    NEXT
    FOR x = high to 0 STEP -100
        FOR I = 1 to numberoflines
            IF scores(i) > 0 THEN
                IF scores(i) = x then
                    OUTPUT to listbox
                ENDIF
            ENDIF
        NEXT
END
```

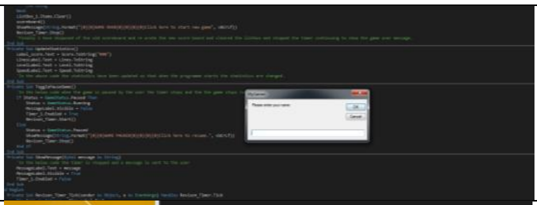
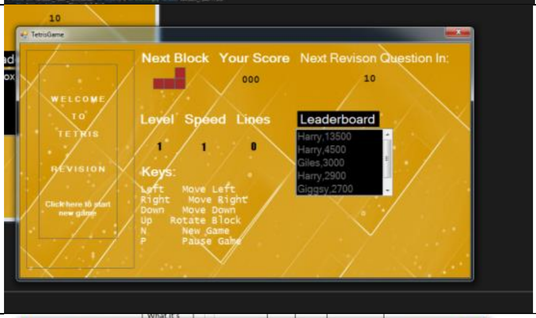
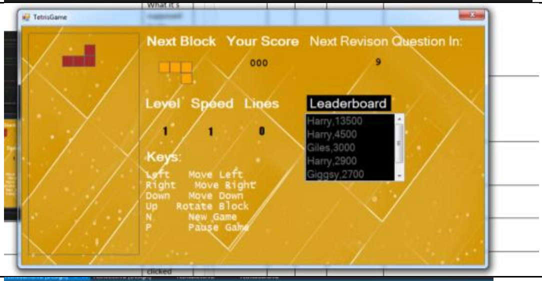
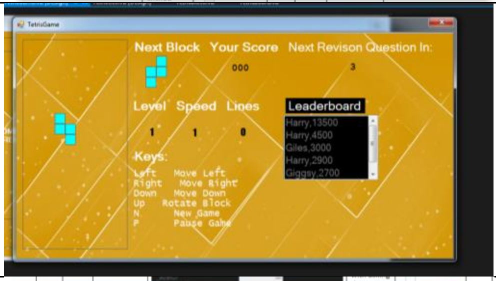
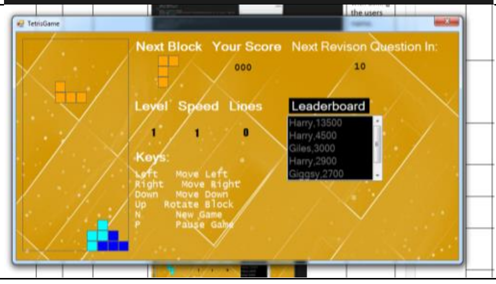
Pseudo code of rows being checked and the scoring for each line

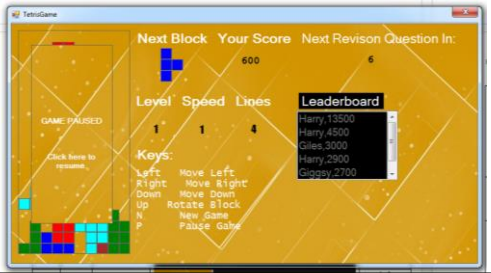
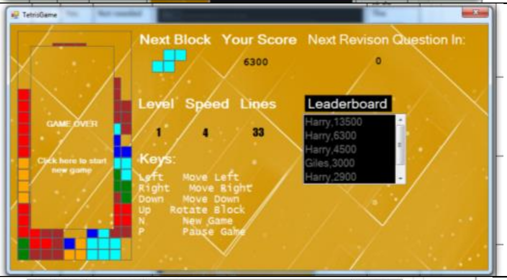
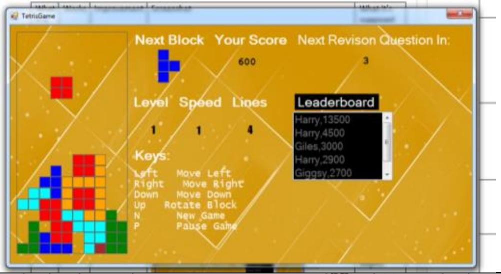
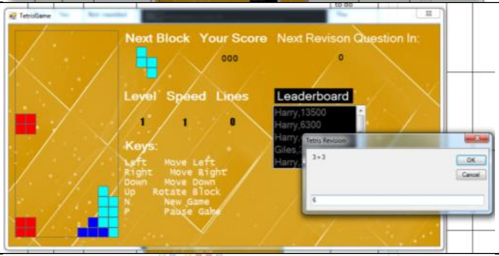
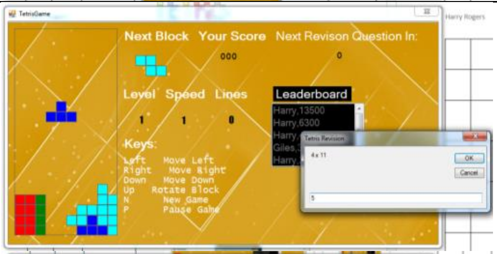
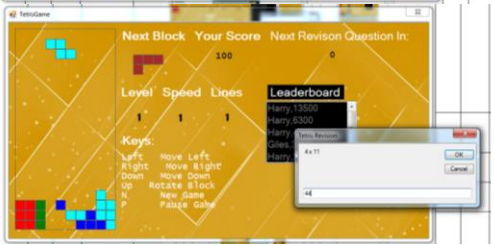
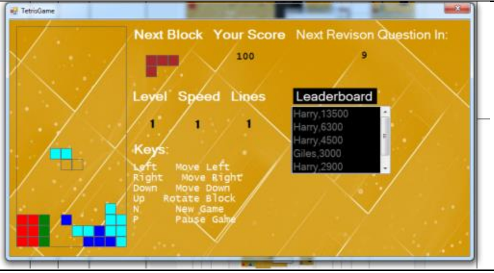
The below pseudo code shows how the blocks will fall and also how the rows are checked each time a new block falls. This will then add the score up of how many lines are completed and will increase the speed and also drop the next block.

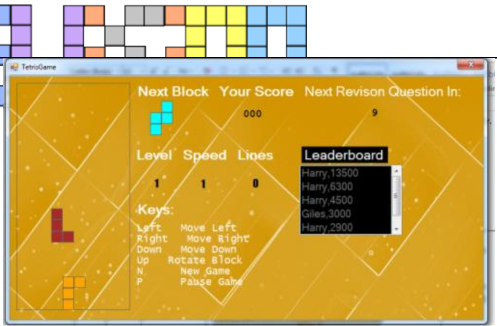
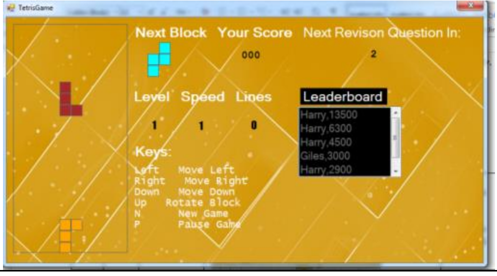
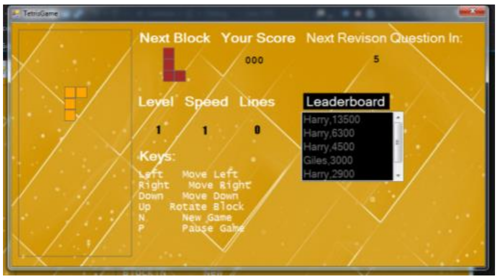
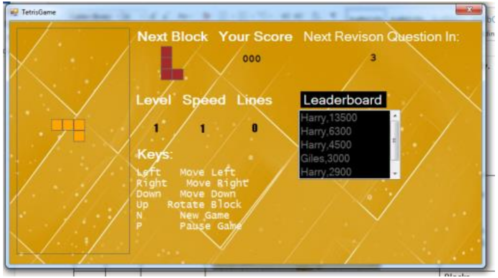
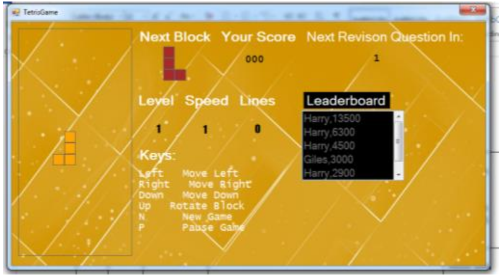
```
START
        IF fallingblock.canmove  = TRUE THEN
                Fallingblock.movedown
        ELSE
                Checkrows = 0
        ENDIF

        checkrows FROM fallingblock.cells
`       ORDER cell.row
        Rowsremoved = 0
        FOR EACH row IN checkrows
                IF gameboard.rowiscomplete(row) THEN
                        gameboard.removerow(row)
                        rowsremoved =+1
                END IF                          //In the above code the blocks fall if there is space to do so the rows are then checked to see if they are completed and then added to amount of rows that are removed. In the below code the speed of the blocks falling is increased due to the amount of lines they have completed at once. Once the blocks can't fall at the centre the game ends.
        NEXT
        Score=+100
        Lines=+1
        Speed= lines / 10
        Updatestats()
        Dropnextblock()
        IF NOT fallingblock.canmove(Fallingblock.centrecell) THEN
                endgame()
        END IF
END
```

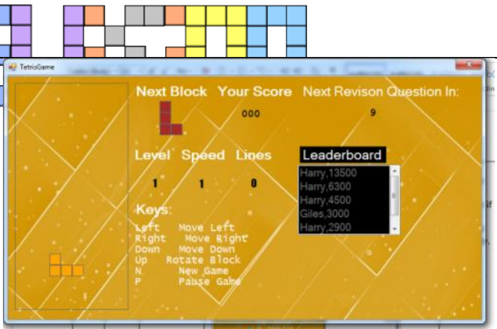
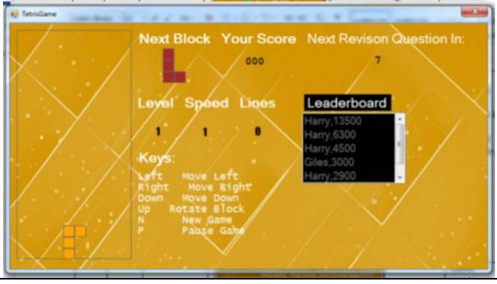
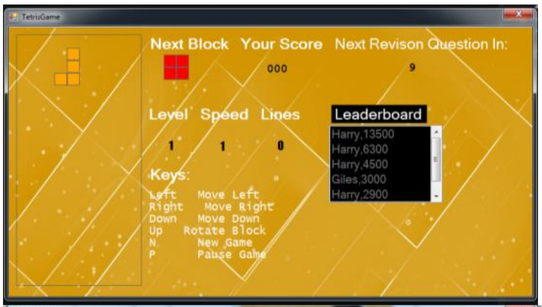
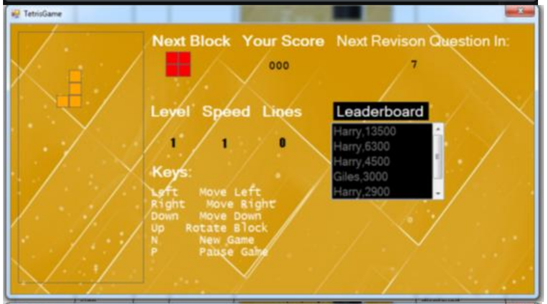
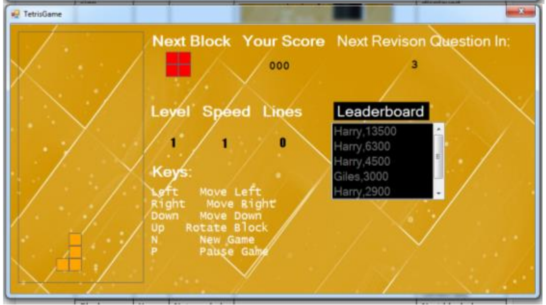
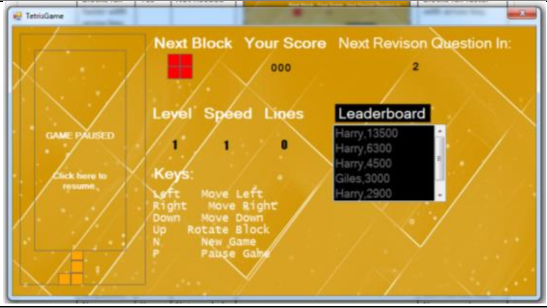
Testing

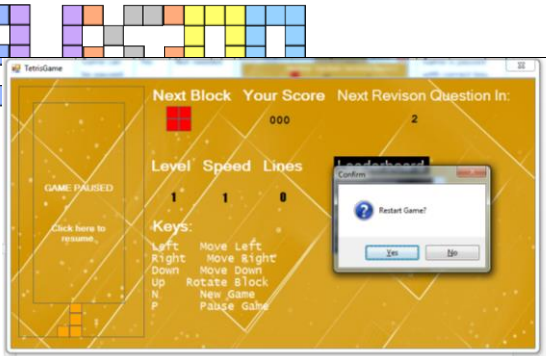
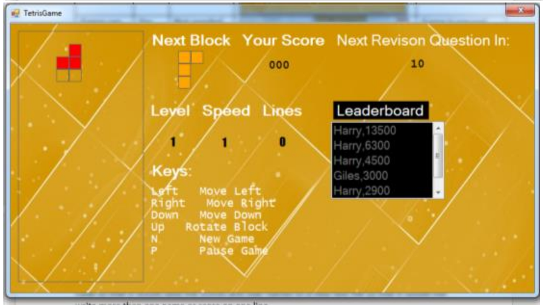
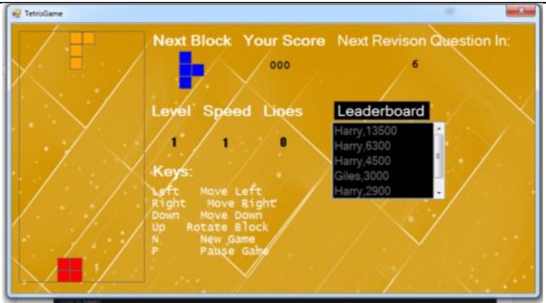
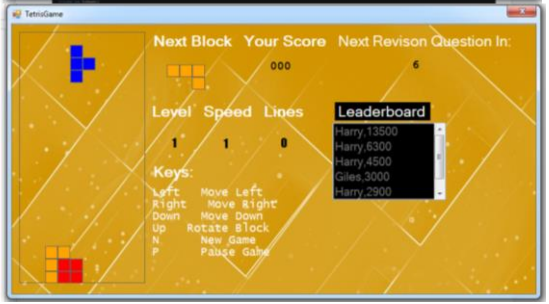
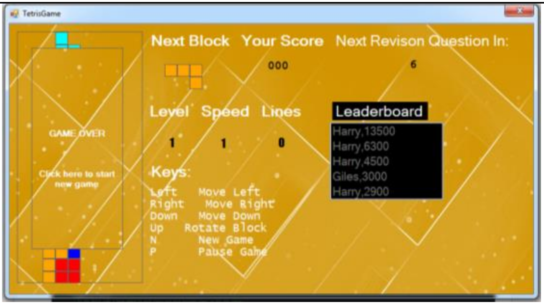
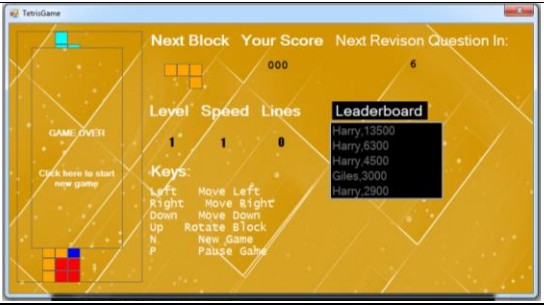
Testing Table

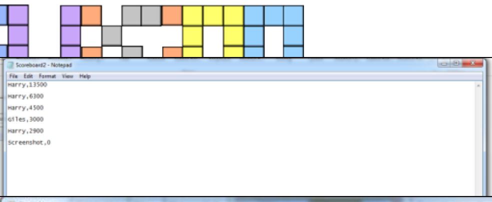
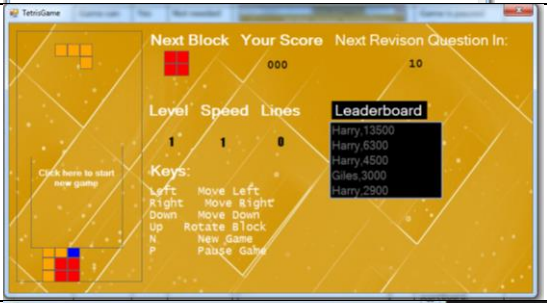
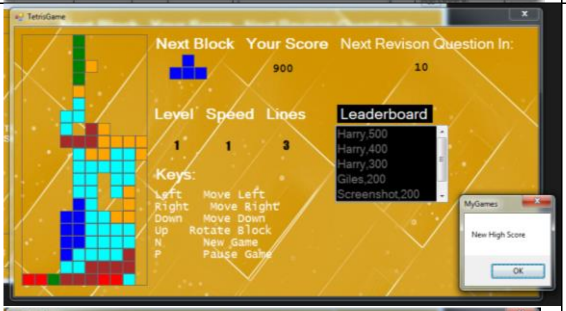
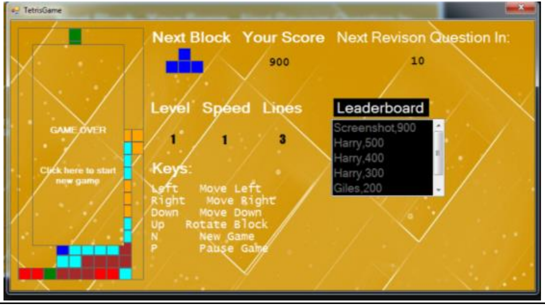
What it is	Works	Improvement	Screenshot	What it's supposed to do
Run	Yes	Not needed		The program should start with asking the users name.
Load up correct form.	Yes	Not needed	 TetrisGame WELCOME TO TETRIS REVISION Click here to start new game Next Block Your Score Next Revison Question In: 000 10 Level Speed Lines 1 1 0 Leaderboard Harry,13500 Harry,4500 Giles,3000 Harry,2900 Giggsy,2700 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	Loads form up with correct labels, scoreboard and Tetris area.
Game begins.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 9 Level Speed Lines 1 1 0 Leaderboard Harry,13500 Harry,4500 Giles,3000 Harry,2900 Giggsy,2700 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	Once clicked game begins.
Blocks fall.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 3 Level Speed Lines 1 1 0 Leaderboard Harry,13500 Harry,4500 Giles,3000 Harry,2900 Giggsy,2700 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	Blocks fall from the top.
Blocks set.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 10 Level Speed Lines 1 1 0 Leaderboard Harry,13500 Harry,4500 Giles,3000 Harry,2900 Giggsy,2700 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	Blocks set at the correct point.

Rows are completed.	Yes	Not needed		Rows are removed once completed.
Lines and speed increases over time.	Yes	Not needed		Lines and speed increase when the player completes more lines.
Revision timer ticks.	Yes	Not needed		Timer ticks and shows the time before next question.
Revision questions.	Yes	Not needed		Revision questions appear and can be completed.
Revision questions answers.	Yes	Not needed	 	Revision questions don't disappear if closed or answered incorrectly.
Game continues.	Yes	Not needed		Game continues when revision questions are asked.

Blocks move.	Yes	Not needed	Next Block Your Score Next Revison Question In: 000 9 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900 Next Block Your Score Next Revison Question In: 000 2 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Blocks move with each arrow key.
Blocks rotate.	Yes	Not needed	Next Block Your Score Next Revison Question In: 000 5 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900 Next Block Your Score Next Revison Question In: 000 3 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900 Next Block Your Score Next Revison Question In: 000 1 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Blocks rotate with arrow key all the way around.

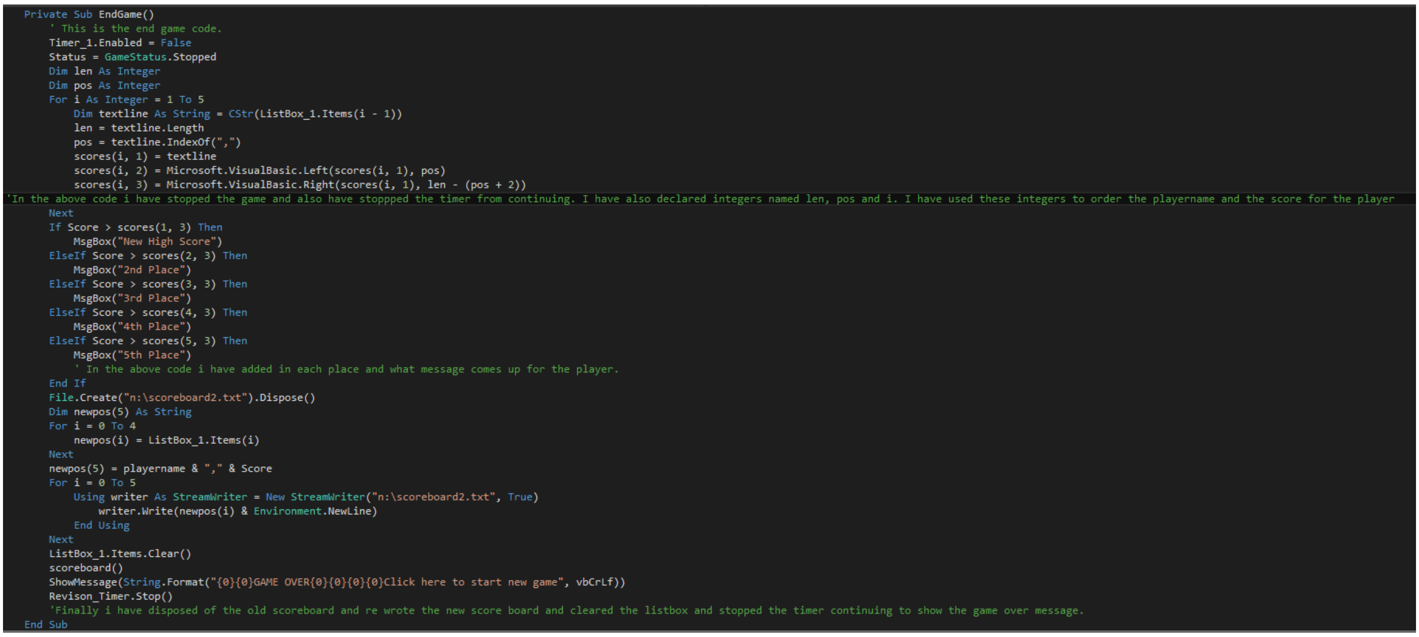
			 TetrisGame Next Block Your Score Next Revison Question In: 000 9 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900  TetrisGame Next Block Your Score Next Revison Question In: 000 7 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	
Blocks fall faster with arrow key.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 9 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900  TetrisGame Next Block Your Score Next Revison Question In: 000 7 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900  TetrisGame Next Block Your Score Next Revison Question In: 000 3 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Blocks fall faster with arrow key.
Game can be paused.	Yes	Not needed	 TetrisGame GAME PAUSED Click here to resume. Next Block Your Score Next Revison Question In: 000 2 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Game is paused with correct key.

New game can begin.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 2 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game GAME PAUSED Click here to resume Leaderboard Confirm Restart Game? Yes No  TetrisGame Next Block Your Score Next Revison Question In: 000 10 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	New game is started with correct key.
Blocks shown.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 6 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900  TetrisGame Next Block Your Score Next Revison Question In: 000 6 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Next block shown is the next block to fall.
Game stops.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 6 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game GAME OVER Click here to start new game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Game is stopped once blocks reach the top.
Game over sign.	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: 000 6 Level Speed Lines 1 1 0 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game GAME OVER Click here to start new game Leaderboard Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900	Game over sign is displayed.

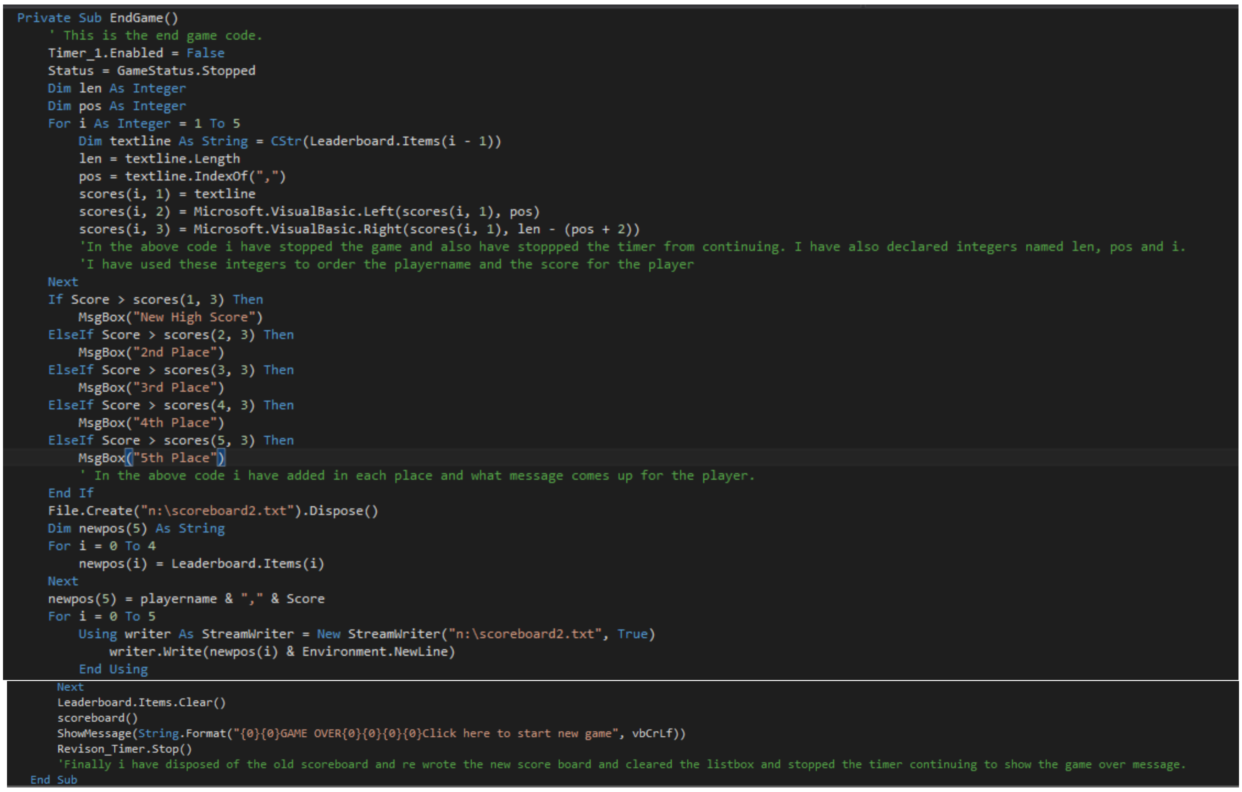
Scoreboard.	Yes	Not needed	 Scoreboard2 - Notepad Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900 Screenshot,0	Score is saved with user name to the scoreboard.
New game	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: Level Speed Lines Leaderboard Click here to start new game 000 10 1 1 0 Harry,13500 Harry,6300 Harry,4500 Giles,3000 Harry,2900 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	New game can begin.
Messaging	Yes	Not needed	 TetrisGame Next Block Your Score Next Revison Question In: Level Speed Lines Leaderboard 900 10 1 1 3 Harry,500 Harry,400 Harry,300 Giles,200 Screenshot,200 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game MyGames New High Score  TetrisGame Next Block Your Score Next Revison Question In: Level Speed Lines Leaderboard GAME OVER Click here to start new game 900 10 1 1 3 Screenshot,900 Harry,500 Harry,400 Harry,300 Giles,200 Keys: Left Move Left Right Move Right Down Move Down Up Rotate Block N New Game P Pause Game	Correct message is shown to user after they achieve a new high score.

Black Box testing

The black box testing I have used tested the scoreboard as well as the use of the falling blocks, moving the blocks and rotating them. In which the code has made the blocks fall and rotate them however they need to be for the player. I had to re-try the scoreboard code multiple times as it wouldn't work. I had a system where it would read a text file and save the users name and their score, however it would not write them correctly as it would write more than one name and score on one line so when the programme read the text file it wouldn't have the correct names and scores on the leader board. So I re-wrote the entire code so that it would save the scores and user names to a new text file so that it would not write more than one name or score on one line. The second screenshot is the final adaption of the End Game procedure.



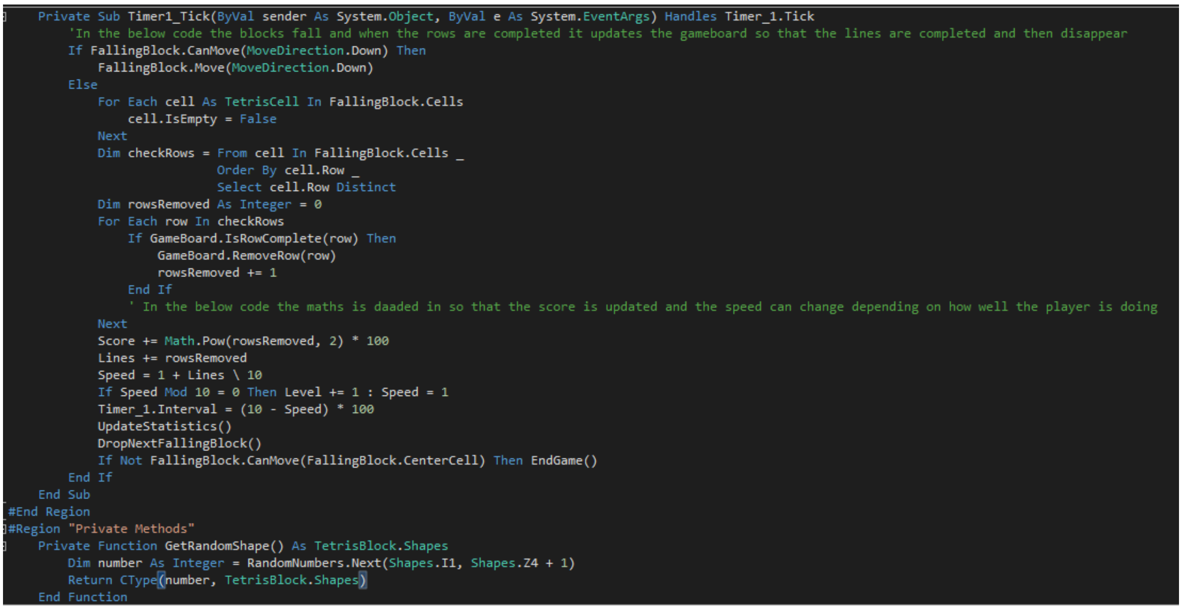
```
    Private Sub EndGame()
        ' This is the end game code.
        Timer_1.Enabled = False
        Status = GameStatus.Stopped
        Dim len As Integer
        Dim pos As Integer
        For i As Integer = 1 To 5
            Dim textline As String = CStr(ListBox_1.Items(i - 1))
            len = textline.Length
            pos = textline.IndexOf(",")
            scores(i, 1) = textline
            scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
            scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos + 2))
'In the above code i have stopped the game and also have stoppped the timer from continuing. I have also declared integers named len, pos and i. I have used these integers to order the playername and the score for the player
        Next
        If Score > scores(1, 3) Then
            MsgBox("New High Score")
        ElseIf Score > scores(2, 3) Then
            MsgBox("2nd Place")
        ElseIf Score > scores(3, 3) Then
            MsgBox("3rd Place")
        ElseIf Score > scores(4, 3) Then
            MsgBox("4th Place")
        ElseIf Score > scores(5, 3) Then
            MsgBox("5th Place")
            ' In the above code i have added in each place and what message comes up for the player.
        End If
        File.Create("n:\scoreboard2.txt").Dispose()
        Dim newpos(5) As String
        For i = 0 To 4
            newpos(i) = ListBox_1.Items(i)
        Next
        newpos(5) = playername & "," & Score
        For i = 0 To 5
            Using writer As StreamWriter = New StreamWriter("n:\scoreboard2.txt", True)
                writer.Write(newpos(i) & Environment.NewLine)
            End Using
        Next
        ListBox_1.Items.Clear()
        scoreboard()
        ShowMessage(String.Format("{0}{0}GAME OVER{0}{0}{0}{0}Click here to start new game", vbCrLf))
        Revison_Timer.Stop()
        'Finally i have disposed of the old scoreboard and re wrote the new score board and cleared the listbox and stopped the timer continuing to show the game over message.
    End Sub
```



```
    Private Sub EndGame()
        ' This is the end game code.
        Timer_1.Enabled = False
        Status = GameStatus.Stopped
        Dim len As Integer
        Dim pos As Integer
        For i As Integer = 1 To 5
            Dim textline As String = CStr(Leaderboard.Items(i - 1))
            len = textline.Length
            pos = textline.IndexOf(",")
            scores(i, 1) = textline
            scores(i, 2) = Microsoft.VisualBasic.Left(scores(i, 1), pos)
            scores(i, 3) = Microsoft.VisualBasic.Right(scores(i, 1), len - (pos + 2))
            'In the above code i have stopped the game and also have stoppped the timer from continuing. I have also declared integers named len, pos and i.
            'I have used these integers to order the playername and the score for the player
        Next
        If Score > scores(1, 3) Then
            MsgBox("New High Score")
        ElseIf Score > scores(2, 3) Then
            MsgBox("2nd Place")
        ElseIf Score > scores(3, 3) Then
            MsgBox("3rd Place")
        ElseIf Score > scores(4, 3) Then
            MsgBox("4th Place")
        ElseIf Score > scores(5, 3) Then
            MsgBox("5th Place")
            ' In the above code i have added in each place and what message comes up for the player.
        End If
        File.Create("n:\scoreboard2.txt").Dispose()
        Dim newpos(5) As String
        For i = 0 To 4
            newpos(i) = Leaderboard.Items(i)
        Next
        newpos(5) = playername & "," & Score
        For i = 0 To 5
            Using writer As StreamWriter = New StreamWriter("n:\scoreboard2.txt", True)
                writer.Write(newpos(i) & Environment.NewLine)
            End Using
        Next
        Leaderboard.Items.Clear()
        scoreboard()
        ShowMessage(String.Format("{0}{0}GAME OVER{0}{0}{0}{0}Click here to start new game", vbCrLf))
        Revison_Timer.Stop()
        'Finally i have disposed of the old scoreboard and re wrote the new score board and cleared the listbox and stopped the timer continuing to show the game over message.
    End Sub
```

White Box testing

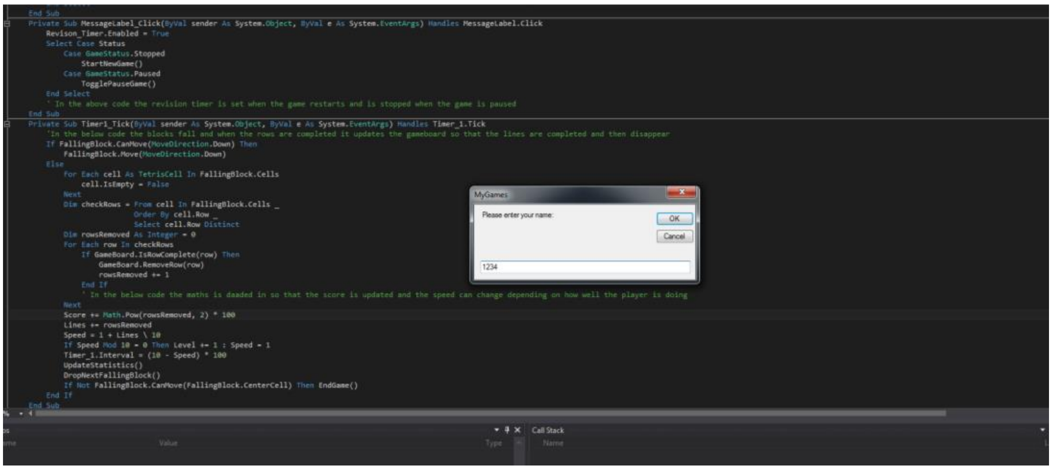
The white box testing I have used incorporates all code together making sure the scoring system works while changing the speed of the falling blocks as well as the multipliers for the scoring system. I have also teste how the lines disappear and are stored so that the scoring system works as well as then the game can continue and play on until the user loses. Through the use of the variable called check rows I can see if the lines are being deleted so that the user can then place more blocks into the original area. I also changed the speed of the falling blocks several times but however kept with the original speed due to it being too fast to play.



```
    Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Timer_1.Tick
        'In the below code the blocks fall and when the rows are completed it updates the gameboard so that the lines are completed and then disappear
        If FallingBlock.CanMove(MoveDirection.Down) Then
            FallingBlock.Move(MoveDirection.Down)
        Else
            For Each cell As TetrisCell In FallingBlock.Cells
                cell.IsEmpty = False
            Next
            Dim checkRows = From cell In FallingBlock.Cells _
                            Order By cell.Row _
                            Select cell.Row Distinct
            Dim rowsRemoved As Integer = 0
            For Each row In checkRows
                If GameBoard.IsRowComplete(row) Then
                    GameBoard.RemoveRow(row)
                    rowsRemoved += 1
                End If
                ' In the below code the maths is daaded in so that the score is updated and the speed can change depending on how well the player is doing
            Next
            Score += Math.Pow(rowsRemoved, 2) * 100
            Lines += rowsRemoved
            Speed = 1 + Lines \ 10
            If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
            Timer_1.Interval = (10 - Speed) * 100
            UpdateStatistics()
            DropNextFallingBlock()
            If Not FallingBlock.CanMove(FallingBlock.CenterCell) Then EndGame()
        End If
    End Sub
#End Region
#Region "Private Methods"
    Private Function GetRandomShape() As TetrisBlock.Shapes
        Dim number As Integer = RandomNumbers.Next(Shapes.I1, Shapes.Z4 + 1)
        Return CType(number, TetrisBlock.Shapes)
    End Function
```

Alpha testing

I have completed lots of alpha testing through using my programme in which it involves me inputting different names and things into the name at the beginning so that the game can save the players score. I have also tested the effectiveness of how the game plays as I did encounter a bug where the game would not end even if the blocks couldn't stay on the playing board.

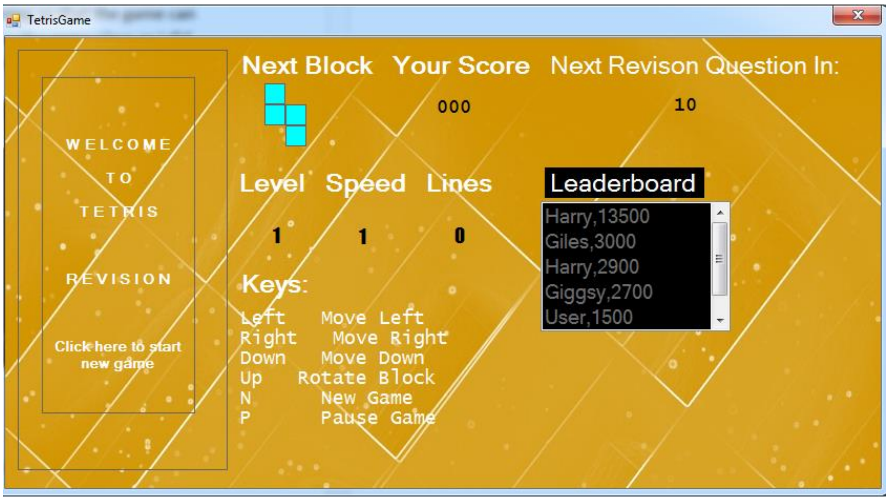


```
    End Sub
    Private Sub MessageLabel_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MessageLabel.Click
        Revison_Timer.Enabled = True
        Select Case Status
            Case GameStatus.Stopped
                StartNewGame()
            Case GameStatus.Paused
                TogglePauseGame()
        End Select
        ' In the above code the revision timer is set when the game restarts and is stopped when the game is paused
    End Sub
    Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Timer_1.Tick
        'In the below code the blocks fall and when the rows are completed it updates the gameboard so that the lines are completed and then disappear
        If FallingBlock.CanMove(MoveDirection.Down) Then
            FallingBlock.Move(MoveDirection.Down)
        Else
            For Each cell As TetrisCell In FallingBlock.Cells
                cell.IsEmpty = False
            Next
            Dim checkRows = From cell In FallingBlock.Cells _
                            Order By cell.Row _
                            Select cell.Row Distinct
            Dim rowsRemoved As Integer = 0
            For Each row In checkRows
                If GameBoard.IsRowComplete(row) Then
                    GameBoard.RemoveRow(row)
                    rowsRemoved += 1
                End If
                ' In the below code the maths is daaded in so that the score is updated and the speed can change depending on how well the player is doing
            Next
            Score += Math.Pow(rowsRemoved, 2) * 100
            Lines += rowsRemoved
            Speed = 1 + Lines \ 10
            If Speed Mod 10 = 0 Then Level += 1 : Speed = 1
            Timer_1.Interval = (10 - Speed) * 100
            UpdateStatistics()
            DropNextFallingBlock()
            If Not FallingBlock.CanMove(FallingBlock.CenterCell) Then EndGame()
        End If
    End Sub
```

MyGames

Please enter your name:

1234



TetrisGame
WELCOME TO TETRIS REVISION
Click here to start new game
Next Block
Your Score
Next Revison Question In:
000
10
Level
Speed
Lines
1
1
0
Leaderboard

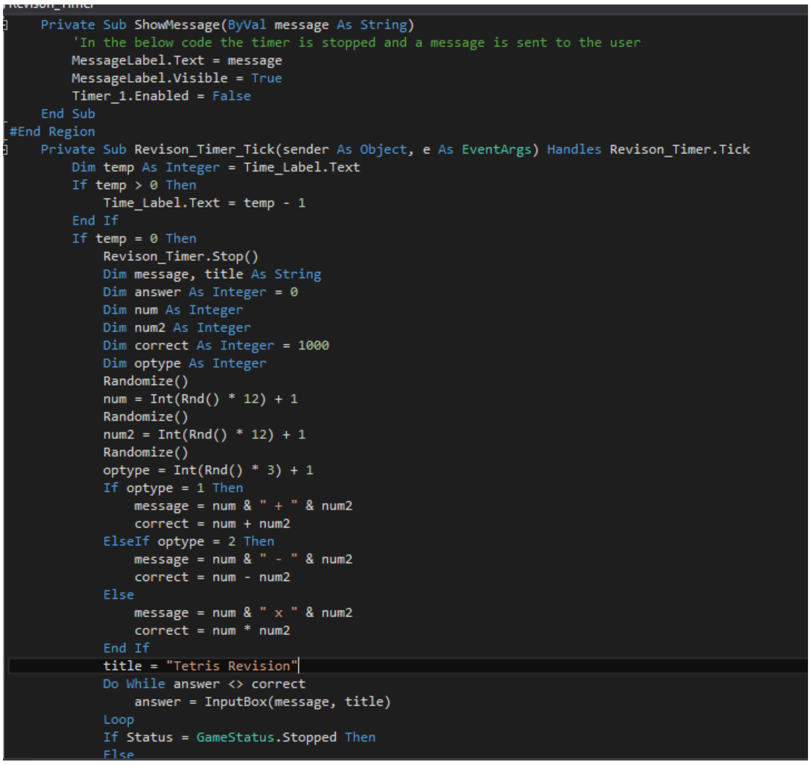
Harry,13500
Giles,3000
Harry,2900
Giggsy,2700
User,1500

Keys:

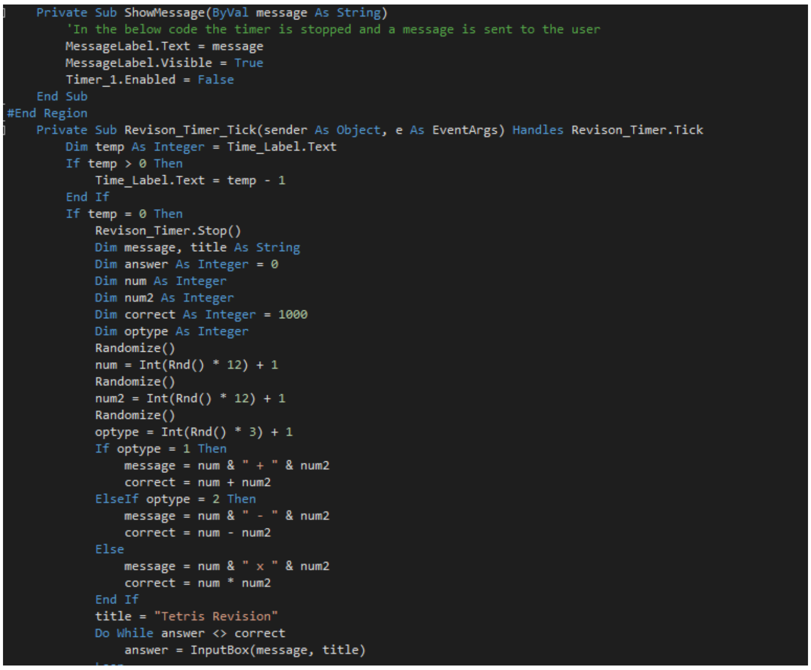
```
Left     Move Left
Right     Move Right
Down     Move Down
Up     Rotate Block
N        New Game
P        Pause Game
```

Beta testing

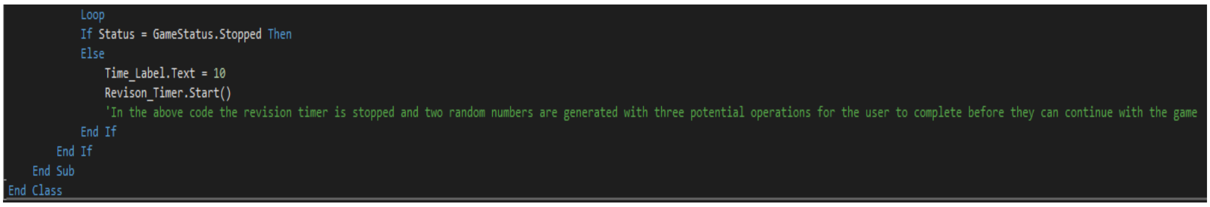
I had some of my classmates test and use the programme for its intended purpose. In which they found very few problems with the programme as I had completed lots of alpha testing. One tester had discovered that the pop up question sometimes be skipped however once this was discovered I had replaced the old code with a new way of the user answering questions for their revision.



```
    Private Sub ShowMessage(ByVal message As String)
        'In the below code the timer is stopped and a message is sent to the user
        MessageLabel.Text = message
        MessageLabel.Visible = True
        Timer_1.Enabled = False
    End Sub
#End Region
    Private Sub Revison_Timer_Tick(sender As Object, e As EventArgs) Handles Revison_Timer.Tick
        Dim temp As Integer = Time_Label.Text
        If temp > 0 Then
            Time_Label.Text = temp - 1
        End If
        If temp = 0 Then
            Revison_Timer.Stop()
            Dim message, title As String
            Dim answer As Integer = 0
            Dim num As Integer
            Dim num2 As Integer
            Dim correct As Integer = 1000
            Dim optype As Integer
            Randomize()
            num = Int(Rnd() * 12) + 1
            Randomize()
            num2 = Int(Rnd() * 12) + 1
            Randomize()
            optype = Int(Rnd() * 3) + 1
            If optype = 1 Then
                message = num & " + " & num2
                correct = num + num2
            ElseIf optype = 2 Then
                message = num & " - " & num2
                correct = num - num2
            Else
                message = num & " x " & num2
                correct = num * num2
            End If
            title = "Tetris Revision"
            Do While answer <> correct
                answer = InputBox(message, title)
            Loop
            If Status = GameStatus.Stopped Then
            Else
```



```
    Private Sub ShowMessage(ByVal message As String)
        'In the below code the timer is stopped and a message is sent to the user
        MessageLabel.Text = message
        MessageLabel.Visible = True
        Timer_1.Enabled = False
    End Sub
#End Region
    Private Sub Revison_Timer_Tick(sender As Object, e As EventArgs) Handles Revison_Timer.Tick
        Dim temp As Integer = Time_Label.Text
        If temp > 0 Then
            Time_Label.Text = temp - 1
        End If
        If temp = 0 Then
            Revison_Timer.Stop()
            Dim message, title As String
            Dim answer As Integer = 0
            Dim num As Integer
            Dim num2 As Integer
            Dim correct As Integer = 1000
            Dim optype As Integer
            Randomize()
            num = Int(Rnd() * 12) + 1
            Randomize()
            num2 = Int(Rnd() * 12) + 1
            Randomize()
            optype = Int(Rnd() * 3) + 1
            If optype = 1 Then
                message = num & " + " & num2
                correct = num + num2
            ElseIf optype = 2 Then
                message = num & " - " & num2
                correct = num - num2
            Else
                message = num & " x " & num2
                correct = num * num2
            End If
            title = "Tetris Revision"
            Do While answer <> correct
                answer = InputBox(message, title)
```



```
            Loop
            If Status = GameStatus.Stopped Then
            Else
                Time_Label.Text = 10
                Revison_Timer.Start()
                'In the above code the revision timer is stopped and two random numbers are generated with three potential operations for the user to complete before they can continue with the game
            End If
        End If
    End Sub
End Class
```

Acceptance testing

My acceptance testing is where I gave the finished programme to my client. I attached a questionnaire which is shown below. These were my aims and objectives as well as the clients.

My aims and objectives

Aims: To help students revise maths
Objectives:

- The program must move blocks down.
- The program must have a leader board.
- The program must have a working score counter.
- The program must have blocks that are moved by arrow keys.
- Have students that improve their maths skills from using the program.

My client's aims and objectives

Aims: To help students pass maths exams
Objectives:

- The program must have maths related questions.
- The program must be able to work on desktop computers.
- The program must be fun for students.

I believe I have completed these as the program moves blocks down as well as having a working leader board. Furthermore, the score counter works in sync with the leader board. The blocks during the game can also be rotated and moved by arrow keys. Finally my program involves maths revision for students to improve their maths skills as it is quick fire questions that are asked whilst enjoying a game.

Furthermore, I believe I have completed the client's aims and objectives as the program asks maths related questions. The program also works on desktop computers as it was created on a desktop computer. This program will also help students pass maths related exams as the teachers I have asked said that quick fire questions would be most suitable for the students to learn. Finally the program is fun and enjoyable for students as it is a game of Tetris that has been tested to help them with maths and to have fun with the game.

Below is the questionnaire and the response from the client.

Tetris Revision

1. Has this programme improved the way maths revision is completed? (Give examples)

………

………

………

………

………

2. Does the programme work as expected?

………

………

………

………

………

3. Have the students enjoyed using the program? If yes/no why?

   Yes/No

………

………

………

………

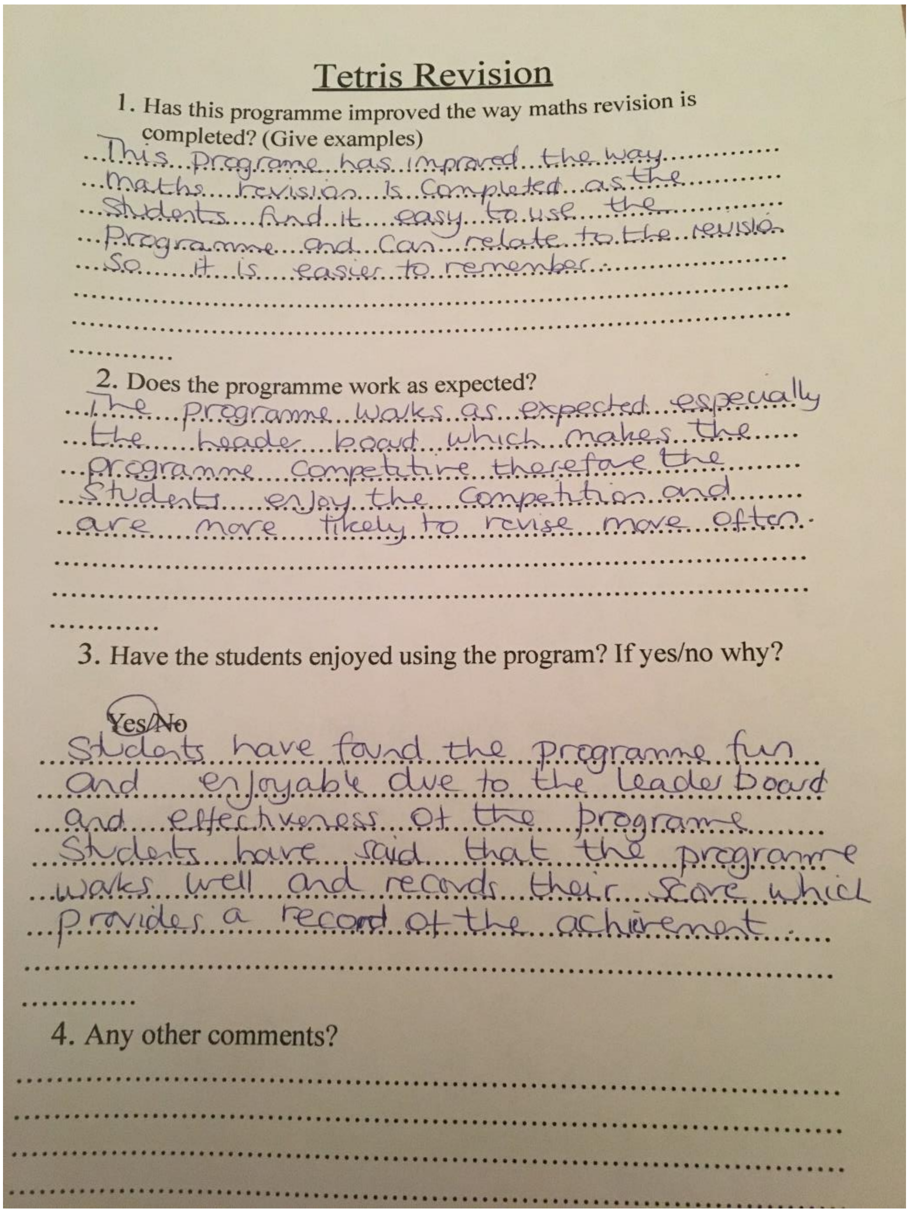
………

4. Any other comments?

………

………

………



Tetris Revision

1. Has this programme improved the way maths revision is completed? (Give examples)

This programme has improved the way maths revision is completed as the students find it easy to use the programme and can relate to the revision so it is easier to remember.

2. Does the programme work as expected?

The programme walks as expected especially the leader board which makes the programme competitive therefore the students enjoy the competition and are more likely to revise more often.

3. Have the students enjoyed using the program? If yes/no why?

[✓ Yes]/No

Students have found the programme fun and enjoyable due to the leader board and effectiveness of the programe. Students have said that the programme walks well and records their score which provides a record of the achievement.

4. Any other comments?

From this response, the aims and objectives have been met as the client has said the programme has improved maths revision for students in a fun and easy way. This programme according to the client has worked as expected which involved the use of the leader board which encouraged more students to revise maths this meant the score counter worked correctly as this kept the scores of the students. The programme has moving blocks as the students could use the programme as a game and revision. The programme worked on desktop computers so the students can use it at school and at home for revision. The programme was used by students by using the arrow keys as they felt more comfortable using those instead of using w, a, s, d. The students also enjoyed the programme so they are more likely to remember what they revised and will likely come back and use the programme again.

Evaluation

My programme Tetris Revision, I believe, has been successful due to the aims and objectives being completed as well as the programme being able to properly test students on their maths skills. Furthermore, my programme has been tested using extreme and typical data involving, in my programme specific, names for players. Moreover, my programme saves and re-loads scores that players have set even when extreme data is input. Additionally, Tetris Revision has been tested by users that decided they wanted to break the programme however the programme was robust enough to continue and users were not able to find any bugs.

Despite the success there are things that could be improved such as the questions that are being asked for the students could be improved. In which the questions would be more complex and instead of asking simple questions such as $5+11$ the programme could ask Simplify $\sqrt{9}$ or $2x + 3/x-4 - 2x - 8/2x+1 = 1$ Find x. Tetris Revision could also be improved by updating saved scores from other users onto a global scoreboard that everyone could see in real time. These improvements would improve the quality of my programme as it would become more competitive. Consequently, inviting other users to play and learn. Adding in more complex questions could also improve the range of the audience as more students could revise from this programme.

In spite of these improvements I have not added them into my programme due to the audience I targeted at. From my research I discovered that the best thing to teach students revising for maths when tests or exams are near is to give quick fire questions that are simple to get students thinking about maths. Including a global leader board would improve the competitive side of the programme but it is designed for students to use for a starting activity. Additionally Tetris is a game in which the scores are not saved globally and this makes the game seem more arcade like which is what I feel the programme should feel like.