

Computer Project

ASHITHA KK 12-D

Certificate

of completion

THIS IS TO CERTIFY THAT

Ashitha K K of class XII-D studying in Shaheed Rajpal DAV Public School has successfully completed her chemistry investigatory project titled:
‘ Sudoku Generator ’.

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Acknowledgement

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An Introduction to Python

Python is a popular high-level programming language that is widely used for developing web applications, scientific computing, data analysis, artificial intelligence, and much more. It was created in the late 1980s by Guido Van Rossum, and has since become one of the most popular programming languages in the world.

One of the reasons for Python's popularity is its easy-to-learn syntax that emphasizes readability and reduces the cost of program maintenance. Python is also an interpreted language, which means that code can be executed

directly without the need for compilation, making it a popular choice for beginners.

Python has a large standard library that provides many useful modules and functions, making it easy to build complex applications quickly.

Additionally, there are many third-party libraries available, such as NumPy, Pandas, and TensorFlow, that extend the capabilities of Python even further.

Overall, Python is an excellent language for both beginners and experienced programmers alike, offering a wide range of capabilities and a vibrant community of developers and users.

Sudoku ?

Sudoku is a popular logic-based puzzle game that has taken the world by storm.

The game is played on a 9x9 grid that is divided into nine 3x3 boxes. The goal here is to fill in the grid with numbers from 1 to 9 such that each row, column, and 3x3 box contains all of the numbers from 1 to 9 without any repetition.

Sudoku is a great way to exercise your brain and improve your problem-solving skills. It requires logical thinking, attention to detail, and patience. The game can be played by people of all ages and skill levels, and there are endless variations and levels of difficulty to keep you challenged and engaged.

In addition to being a fun and challenging game, Sudoku has also been shown to have a number of cognitive benefits.

Studies have found that regular Sudoku play can improve memory, concentration, and mental agility.

So whether you are a seasoned Sudoku pro or just getting started, this addictive puzzle game is sure to provide hours of entertainment and brain-boosting benefits.

Modules used

1. random :

The random module is used for generating random numbers. In the Sudoku program, it has primarily been used to randomly fill in the initial values of the Sudoku grid and to shuffle the order of numbers when attempting to solve the puzzle.

- `random.sample(range(1, 10), 9):`
Generates a list of 9 unique random numbers from 1 to 9. This is used to fill the diagonal grids of the Sudoku puzzle.
- `random.randint(0, 8):` Generates a random integer between 0 and 8, which is used to select a random row or column when removing numbers to create the puzzle's difficulty.

- `random.shuffle()`: Used to shuffle the order of numbers when attempting to solve the Sudoku puzzle.

2. **time** :

The time module is used for introducing delays in the program. It's often used for creating a more user-friendly interface by pausing the execution of the program for a specified duration.

- `time.sleep(seconds)`: Pauses the execution of the program for the specified number of seconds. This is used to introduce delays between different parts of the program to make it more readable and user-friendly.
- `time.time()`: Returns the current time in seconds since the epoch. It has been used to measure the time taken to solve the Sudoku puzzle.

3. CSV :

The CSV module provides functionality for reading from and writing to CSV files. In my program, it has been used to store and retrieve user scores in a CSV file for the Sudoku leaderboard.

- `csv.writer()`: Creates a CSV writer object, which is used to write rows to a CSV file.
- `csv.reader()`: Creates a CSV reader object, which is used to read rows from a CSV file.
- `writerow(row)`: Writes a single row to the CSV file. In your program, it's used to store the user's name and score.
- `reader()`: Reads rows from the CSV file. In your program, it's used to retrieve and display the leaderboard.

The main code

```
1 import random
2 import time
3 import csv
4
5 print("Hello user may I please have your name?")
6 time.sleep(1)
7 name = input("Enter name: ")
8 time.sleep(1)
9 print("Nice to meet you",name)
10 time.sleep(1.5)
11 def start():
12     print("What would you like to do?")
13     time.sleep(1)
14     print('1. Play Sudoku\n2. Leaderboard\n3. Credits\n4. Sudoku? (know more)')
15
16     return(int(input('')))
17
18 def sud():
19     if input("Generate sudoku? (enter y) ")=='y':
20         t_start = time.time()
21
22         def generate_sudoku():
23             grid = [[0 for _ in range(9)] for _ in range(9)]
24             fill_diagonal_grids(grid)
25             solve_sudoku(grid)
26             remove_numbers(grid)
27             return grid
28
29         def fill_diagonal_grids(grid):
30             values = random.sample(range(1, 10), 9)
31
32             for i in range(0, 9, 3):
33                 for j in range(0, 9, 3):
34                     for k in range(3):
35                         for l in range(3):
36                             if values:
37                                 grid[i+k][j+l] = values.pop()
38
39         def solve_sudoku(grid):
40             empty_cell = find_empty_cell(grid)
41             if not empty_cell:
42                 return True
43
44             row, col = empty_cell
45
46             for num in random.sample(range(1, 10), 9):
47                 if is_valid_move(grid, row, col, num):
48                     grid[row][col] = num
49                     if solve_sudoku(grid):
50                         return True
51                     grid[row][col] = 0
52
```

```

53         return False
54
55     def find_empty_cell(grid):
56         for i in range(9):
57             for j in range(9):
58                 if grid[i][j] == 0:
59                     return (i, j)
60         return None
61
62     def is_valid_move(grid, row, col, num):
63         if num in grid[row]:
64             return False
65
66         if num in [grid[i][col] for i in range(9)]:
67             return False
68
69         start_row = (row // 3) * 3
70         start_col = (col // 3) * 3
71         if num in [grid[start_row + i][start_col + j] for i in range(3) for j in range(3)]:
72             return False
73
74         return True
75
76     def remove_numbers(grid):
77         difficulty = 40
78
79         for _ in range(difficulty):
80             while True:
81                 row, col = random.randint(0, 8), random.randint(0, 8)
82                 if grid[row][col] != 0:
83                     temp = grid[row][col]
84                     grid[row][col] = 0
85
86                     copy_grid = [row[:] for row in grid]
87                     if not solve_sudoku(copy_grid):
88                         grid[row][col] = temp
89                         break
90
91         sudoku_puzzle = generate_sudoku()
92
93         for row in sudoku_puzzle:
94             print(' '.join(['_' if cell == 0 else str(cell) for cell in row]))
95
96         if input("Sudoku solved? (press enter button) ") == '':
97             t_end = time.time()
98             score = round(t_end - t_start, 2)
99             print("Time taken = ", score)
100
101         f=open('SudokuScore.csv','a', newline='')
102         n=csv.writer(f, delimiter='\t')
103         n.writerow([name, ' - ', score])
104         f.close()
105     else:
106         print('Invalid input ')
107         time.sleep(1)
108         print('How do you wish to proceed ?')
109         time.sleep(1)
110         sud()
111
112 choice=start()
113 if choice==1:
114     sud()
115

```

```

116 elif choice==2:
117     f=open('SudokuScore.csv', 'r', newline='')
118     w=csv.reader(f, delimiter='\t')
119     for r in w:
120         print(r)
121     f.close()
122
123 elif choice==3:
124     lines = [
125         '',
126         ' C   R   E   D   I   T   S ',
127         '-----',
128         '',
129         '',
130         'Developed by: Ashitha & Sara ',
131         '',
132         'Version: 1.0',
133         'Date: 16-11-25',
134         '',
135         'Thanks for using the program!']
136
137     for line in lines:
138         print(line)
139         time.sleep(1.1)
140
141 if choice==4:
142     lines=[
143         '',
144         ' K N O W     Y O U R     S U D O K U     !',
145         '-----',
146         '',
147         '',
148         'Sudoku is a popular logic-based puzzle game that has taken the world by storm.',
149         'The game is played on a 9x9 grid that is divided into nine 3x3 boxes.',
150         'The goal here is to fill in the grid with numbers from 1 to 9 such that',
151         'each row, column and 3x3 box contains all of the numbers from 1 to 9 without any repetition.',
152         'Sudoku is a great way to exercise your brain and improve your problem-solving skills.',
153         'It requires logical thinking, attention to detail, and patience.',
154         'The game can be played by people of all ages and skill levels.',
155         'and there are endless variations and levels of difficulty to keep you challenged and engaged.'
156
157     for line in lines:
158         print(line)
159         time.sleep(1.2)
160
161 while True:
162     print('')
163     print('What next ?')
164     time.sleep(1)
165     print('1. Generate sudoku !\n2. Back to home screen\n3. Quit ;(')
166     choice2=int(input(''))
167
168     if choice2==1:
169         sud()
170
171     elif choice2==2:
172         start()
173
174     elif choice2==3:
175         time.sleep(1)
176         print('Sad to see you go...',)
177         print('Hope you had fun !')
178         break
179     else:
180         print('Invalid choice. Please enter 1, 2, or 3.')
181

```

Outputs

Starting up, entering name and generating a completely new and unique Sudoku.

```
Hello user may I please have your name?  
Enter name: ashi  
Nice to meet you ashi  
What would you like to do?  
1. Play Sudoku  
2. Leaderboard  
3. Credits  
4. Sudoku? (know more)  
1  
Generate sudoku? (enter y) y  
_ _ _ _ 3 4 _ 6 7  
7 _ _ 9 8 6 3 5 _  
6 3 _ 5 _ 7 9 1 _  
4 _ _ 7 5 9 _ _ 3  
_ _ 3 _ 6 8 _ 4 9  
_ _ _ _ _ 6 _ _  
5 _ _ _ 7 _ _ _ 2  
8 2 _ _ 9 5 4 7 6  
_ 7 6 8 _ _ _ 9 _  
Sudoku solved? (press enter button)  
Time taken = 5.77  
  
What next ?  
1. Generate sudoku !  
2. Back to home screen  
3. Quit ;(
```

The score generated is stored in a CSV file and can be retrieved on command.

Checking out the leaderboard

```
Hello user may I please have your name?  
Enter name: ashi  
Nice to meet you ashi  
What would you like to do?  
1. Play Sudoku  
2. Leaderboard  
3. Credits  
4. Sudoku? (know more)  
2  
['name  ', ' score']  
['ashi', ' - ', '3.61']  
['aki', ' - ', '4.48']  
['Akshaj', ' - ', '5.82']  
['ashi', ' - ', '5.53']  
['ashi', ' - ', '4.35']  
['ashi', ' - ', '1.92']  
['ashi', ' - ', '2.01']  
['ashi', ' - ', '1.26']  
['ashi', ' - ', '0.84']  
['ashi', ' - ', '5.77']  
  
What next ?  
1. Generate sudoku !  
2. Back to home screen  
3. Quit ;(
```

Opening up credits

```
Hello user may I please have your name?  
Enter name: ashi  
Nice to meet you ashi  
What would you like to do?  
1. Play Sudoku  
2. Leaderboard  
3. Credits  
4. Sudoku? (know more)  
3
```

C R E D I T S

Developed by: Ashitha & Sara

Version: 1.0
Date: 16-11-25

Thanks for using the program!

What next ?
1. Generate sudoku !
2. Back to home screen
3. Quit ;(

The ‘know your sudoku panel’, facts about the game, explaining the rules and much more.

```
Hello user may I please have your name?  
Enter name: ashi  
Nice to meet you ashi  
What would you like to do?  
1. Play Sudoku  
2. Leaderboard  
3. Credits  
4. Sudoku? (know more)  
4
```

K N O W Y O U R S U D O K U !

Sudoku is a popular logic-based puzzle game that has taken the world by storm. The game is played on a 9x9 grid that is divided into nine 3x3 boxes. The goal here is to fill in the grid with numbers from 1 to 9 such that, each row, column and 3x3 box contains all of the numbers from 1 to 9 without any repetition. Sudoku is a great way to exercise your brain and improve your problem-solving skills. It requires logical thinking, attention to detail, and patience. The game can be played by people of all ages and skill levels, and there are endless variations and levels of difficulty to keep you challenged and engaged.

What next ?
1. Generate sudoku !
2. Back to home screen
3. Quit ;(

Some additional outputs from the other options available

```
What next ?  
1. Generate sudoku !  
2. Back to home screen  
3. Quit ;(  
2  
What would you like to do?  
1. Play Sudoku  
2. Leaderboard  
3. Credits  
4. Sudoku? (know more)
```

```
What next ?  
1. Generate sudoku !  
2. Back to home screen  
3. Quit ;(  
3  
Sad to see you go... Hope you had fun
```

```
What next ?  
1. Generate sudoku !  
2. Back to home screen  
3. Quit ;(  
1  
Generate sudoku? (enter y) y  
4 _ _ 9 7 5 8 1 _  
_ _ 9 _ _ _ _ 7 5  
1 4 3 5 _ 7 _ _ _  
5 7 _ 8 _ 6 1 _ 3  
_ 9 _ _ 4 1 5 _ 7  
_ _ _ 1 _ 2 _ 6 4  
_ 6 5 7 8 _ _ _ 1  
2 1 4 6 _ 9 _ _ _  
Sudoku solved? (press enter button) |
```

Bibliography

NOTABLE WEBSITES AND RESEARCH TOOLS

- Programiz
- Python tutor
- Hacking.python
- Python4me

DIGITAL ASSISTANCE:

- Python 3.11.4
- Canva
- Youtube