ROBERT GORDON UNIVERSITY ABERDEEN

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BSc (Hons) Artificial Intelligence and Data Science

Module: CM1601 Programming Fundamental

Individual Coursework Report

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Executive summary

This program is designed to manage a horse race event named ‘Rapid Run’ using Python with a detailed report. This report includes flowcharts for all main eight functions which are AHD, UHD, DHD, VHD, SHD, SDD, WHD, and VWH, a task introduction with code, conclusions, assumptions and references. Task are fully described in terms how each function works and what may happen in the output.

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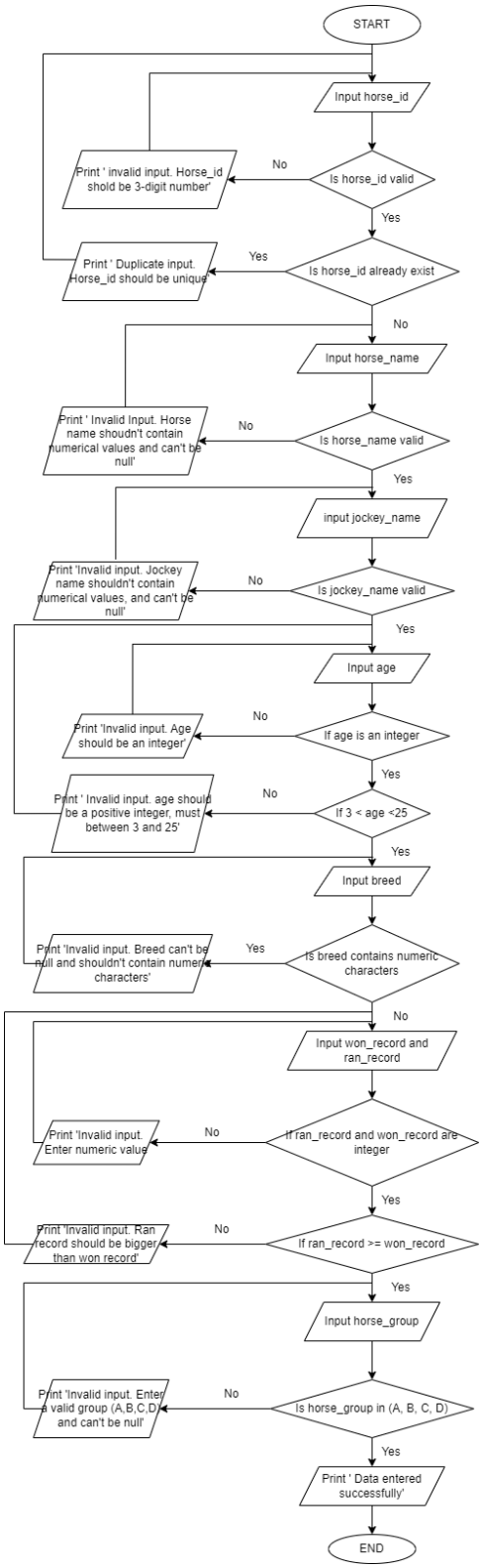

Figure 1 Flowchart for AHD

2. Flowchart for UHD function

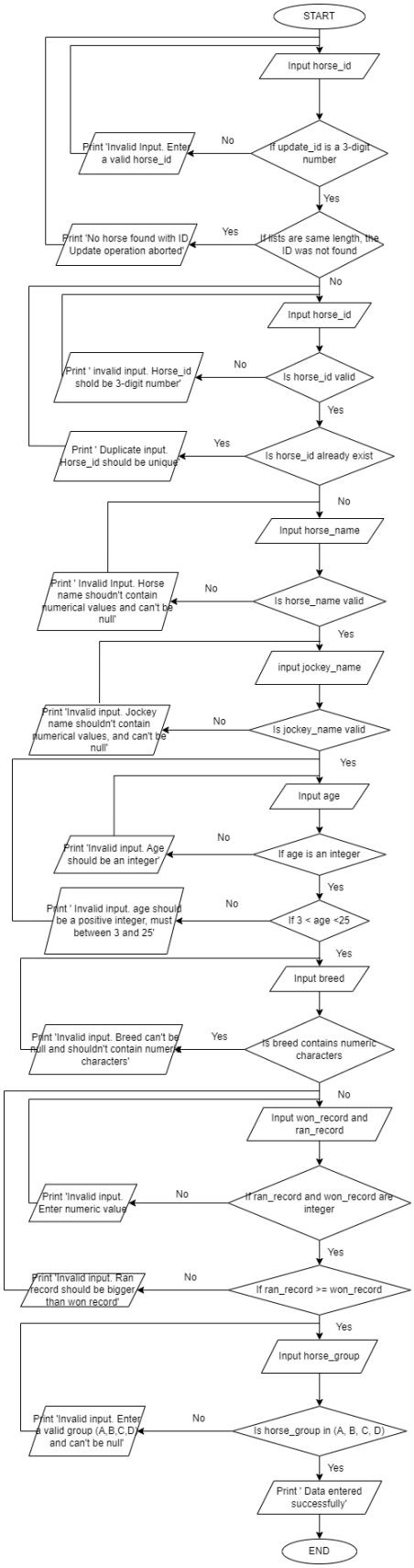

Figure 2 Flowchart for UHD

3. Flowchart for DHD function

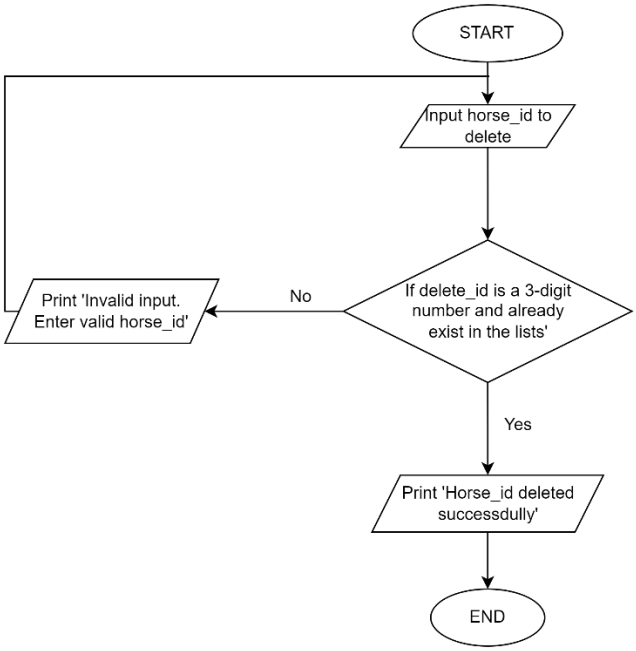

Figure 3 Flowchart for DHD

4. Flowchart for VHD function

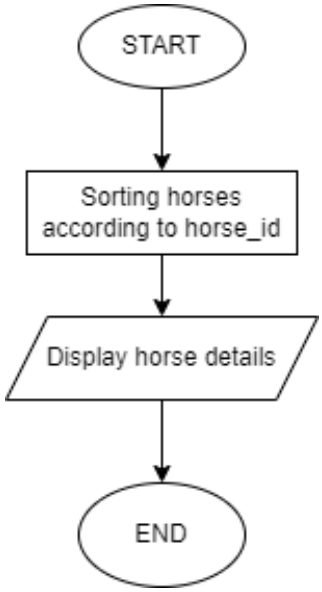

Figure 4 Flowchart for VHD

5. Flowchart for SHD function

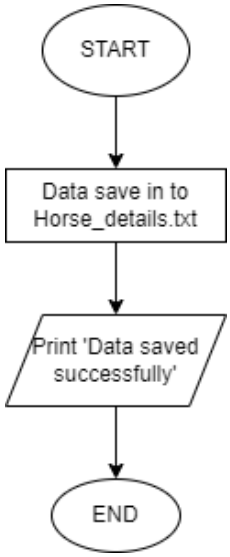

Figure 5 Flowchart for SHD

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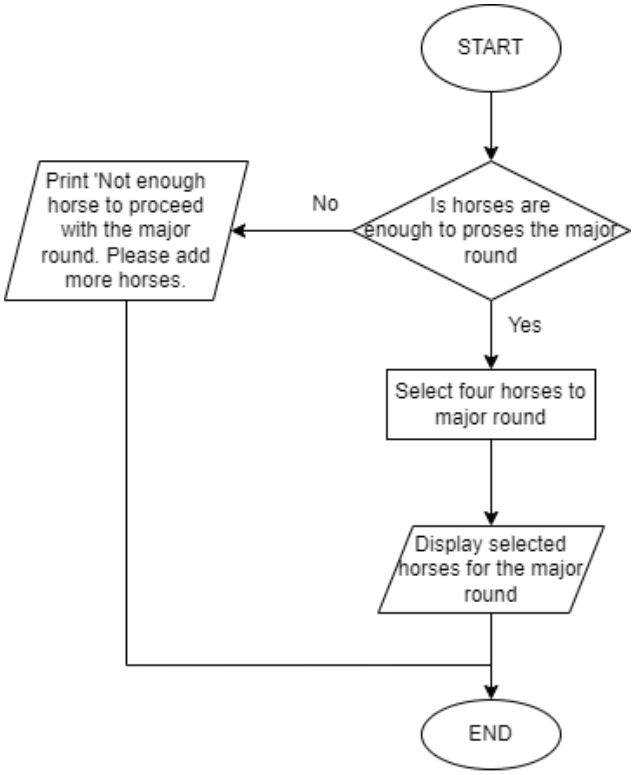

Figure 6 Flowchart for SHD

7. Flowchart for WHD function

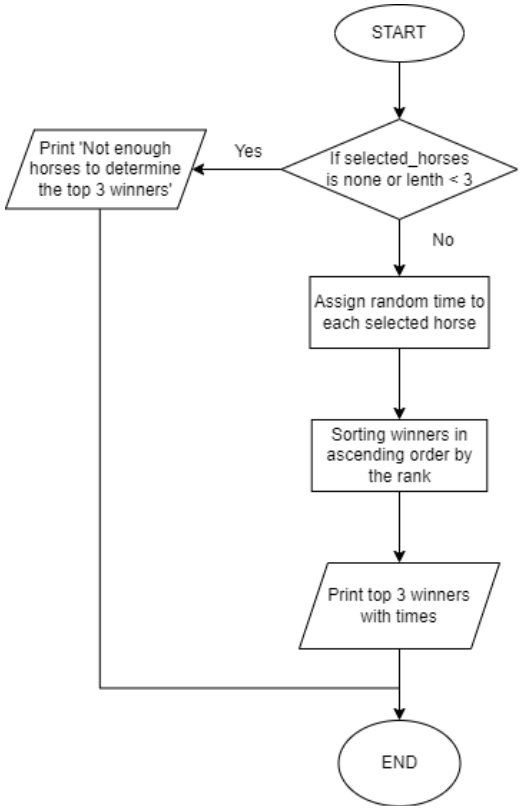

Figure 7 Flowchart for WHD

8. Flowcharts for VWH function

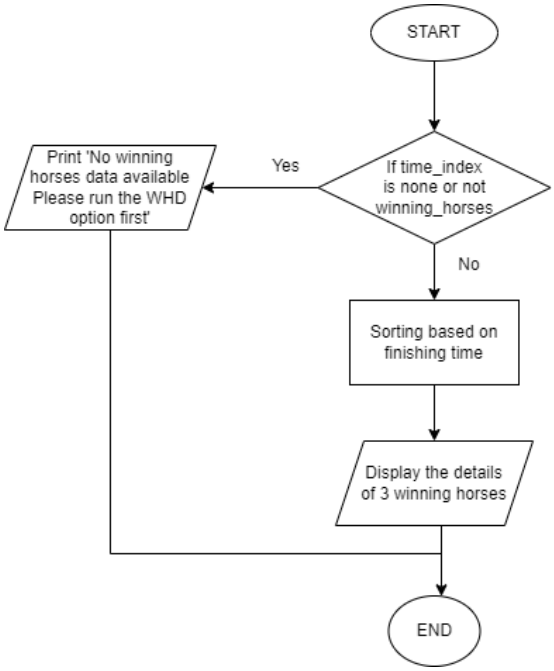

Figure 8 Flowchart for VWH

Code for the program

```
import random

list_of_inputs = []
headers = ["Horse ID", "Horse Name", "Jockey Name", "Age", "Breed", "Wins and Runs",
"Group"]

selected_horses = None
TIME_INDEX = None


def ahd():  # Function to add horse details
    while True:
        horse_id = input("\t\tEnter the horse's ID\t\t\t: ")
        if horse_id.isdigit() and len(horse_id) == 3:
            horse_id = int(horse_id)
            if not is_duplicate_horse_id(horse_id):
                break
            else:
                print("\t\tDuplicate input. HorseID should be unique.")
        else:
            print("\t\tInvalid input. HorseID should be a 3-digit number.")

    while is_duplicate_horse_id(horse_id):
        print("\t\tDuplicate input. HorseID should be unique.")
        horse_id = input("\t\tEnter the horse's ID\t\t\t: ")
        if horse_id.isdigit() and len(horse_id) == 3:
            horse_id = int(horse_id)
        else:
            print("\t\tInvalid input. HorseID should be a 3-digit number.")

    while True:
        horse_name = input("\t\tEnter the horse's name\t\t\t: ")
        if horse_name and not any(char.isdigit() for char in horse_name):
            break
        else:
            print("\t\tInvalid input. Horse name should not contain numerical values,
and cannot be null.")

    while True:
        jockey_name = input("\t\tEnter the jockey's name\t\t\t: ")
        if jockey_name and not any(char.isdigit() for char in jockey_name):
            break
        else:
            print("\t\tInvalid input. Jockey name should not contain numerical
values, and cannot be null.")

    age = None
    while age is None:
        try:
            age = int(input("\t\tEnter the horse's age\t\t\t: "))
            if not (3 < age < 25):
                print("\t\tInvalid input. Age should be a positive integer, must be
higher than 3, lower than 25.")
                age = None
        except ValueError:
            print("\t\tInvalid input. Enter an integer for age.")
            age = None
```

```
    while True:
        breed = input("\t\tEnter the horse's breed\t\t\t: ")
        if breed and not any(char.isdigit() for char in breed):
            break
        else:
            print("\t\tInvalid input. Breed cannot be null and should not contain
numeric characters.")

    won_record = None
    ran_record = None
    while won_record is None or not (0 <= won_record <= ran_record):
        try:
            won_record = int(input("\t\tEnter the number of times horse won\t\t: "))
            ran_record = int(input("\t\tEnter the number of times horse ran\t\t: "))
            if not (0 <= won_record <= ran_record):
                print("\t\t Invalid inputs. Ran record should be bigger than won
record")
        except ValueError:
            print("\t\tInvalid input. Enter numeric values for race records.")
            won_record = None
            ran_record = None

    while True:
        horse_group = input("\t\tEnter the horse's group (A, B, C, D)\t: ").upper()
        if horse_group in {'A', 'B', 'C', 'D'}:
            break
        else:
            print("\t\tInvalid input. Enter a valid group (A, B, C, D) and cannot be
null.")



    print('\t\tData entered successfully')  # Display success message and store
details in the list
    details = [horse_id, horse_name, jockey_name, age, breed, (won_record,
ran_record), horse_group]
    list_of_inputs.append(details)

def is_duplicate_horse_id(horse_id):
    try:
        horse_id = int(horse_id)
        return horse_id in [details[0] for details in list_of_inputs]
    except ValueError:
        return False


def uhd(): # Function to update horse details
    global list_of_inputs

    while True:
        update_id = input("Enter the Horse ID to Update: ")
        if update_id.isdigit() and any(details[0] == int(update_id) for details in
list_of_inputs):
            break
        else:
            print("Invalid input. Please enter a valid Horse ID.")

    # Remove the horse with the specified ID from the list
```

```
    updated_list = [details for details in list_of_inputs if details[0] !=
int(update_id)]

    # If the lists are the same length, the ID was not found
    if len(updated_list) == len(list_of_inputs):
        print(f"No horse found with ID {update_id}. Update operation aborted.")
    else:
        list_of_inputs = updated_list

    while True:
        horse_id = input("\t\tEnter the horse's ID\t\t\t: ")
        if horse_id.isdigit() and len(horse_id) == 3:
            horse_id = int(horse_id)
            if not is_duplicate_horse_id(horse_id):
                break
            else:
                print("\t\tDuplicate input. HorseID should be unique.")
        else:
            print("\t\tInvalid input. HorseID should be a 3-digit number.")

    while is_duplicate_horse_id(horse_id):
        print("\t\tDuplicate input. HorseID should be unique.")
        horse_id = input("\t\tEnter the horse's ID\t\t\t: ")
        if horse_id.isdigit() and len(horse_id) == 3:
            horse_id = int(horse_id)
        else:
            print("\t\tInvalid input. HorseID should be a 3-digit number.")

    while True:
        horse_name = input("\t\tEnter the horse's name\t\t\t: ")
        if horse_name and not any(char.isdigit() for char in horse_name):
            break
        else:
            print("\t\tInvalid input. Horse name should not contain numerical values,
and cannot be null.")

    while True:
        jockey_name = input("\t\tEnter the jockey's name\t\t\t: ")
        if jockey_name and not any(char.isdigit() for char in jockey_name):
            break
        else:
            print("\t\tInvalid input. Jockey name should not contain numerical
values, and cannot be null.")

    age = None
    while age is None:
        try:
            age = int(input("\t\tEnter the horse's age\t\t\t: "))
            if not (3 < age < 25):
                print("\t\tInvalid input. Age should be a positive integer, must be
higher than 3, lower than 25.")
                age = None
        except ValueError:
            print("\t\tInvalid input. Enter an integer for age.")
            age = None

    while True:
        breed = input("\t\tEnter the horse's breed\t\t\t: ")
        if breed and not any(char.isdigit() for char in breed):
            break
```

```
        else:
            print("\t\tInvalid input. Breed cannot be null and should not contain
numeric characters.")

    won_record = None
    ran_record = None
    while won_record is None or not (0 <= won_record <= ran_record):
        try:
            won_record = int(input("\t\tEnter the number of times horse won\t\t: "))
            ran_record = int(input("\t\tEnter the number of times horse ran\t\t: "))
            if not (0 <= won_record <= ran_record):
                print("\t\t Invalid inputs. Ran record should be bigger than won
record")
        except ValueError:
            print("\t\tInvalid input. Enter numeric values for race records.")
            won_record = None
            ran_record = None

    while True:
        horse_group = input("\t\tEnter the horse's group (A, B, C, D)\t: ").upper()
        if horse_group in {'A', 'B', 'C', 'D'}:
            break
        else:
            print("\t\tInvalid input. Enter a valid group (A, B, C, D) and cannot be
null.")


    print('\t\tData entered successfully') # Display success message and store
updated details in the list
    details = [horse_id, horse_name, jockey_name, age, breed, (won_record,
ran_record), horse_group]
    list_of_inputs.append(details)


def dhd():  # Function to delete horse details
    global list_of_inputs

    while True:
        delete_id = input("Enter the Horse ID to Delete: ")
        if delete_id.isdigit() and any(details[0] == int(delete_id) for details in
list_of_inputs):
            break
        else:
            print("Invalid input. Please enter a valid Horse ID.")

    print('Horse_id deleted successfully')
    list_of_inputs = [details for details in list_of_inputs if details[0] !=
int(delete_id)]


def print_details_table(headers, data):  # Function to print horse details table
    for details in data:
        for header, value in zip(headers, details):
            print(f"{header}: {value}", end=", ")
        print("\n" + "-" * 120)  # Separating lines between sets

def vhd():  # Function to view horse details table
    # Bubble sort to sort list_of_inputs based on Horse ID
    n = len(list_of_inputs)
    for i in range(n - 1):
```

```
        for j in range(0, n - i - 1):
            if list_of_inputs[j][0] > list_of_inputs[j + 1][0]:
                list_of_inputs[j], list_of_inputs[j + 1] = list_of_inputs[j + 1],
list_of_inputs[j]

    print("Horse details sorted by Horse ID:")
    print_details_table(headers, list_of_inputs)
    print('\n')


def shd():  # Function to save horse details to a text file
    try:
        with open("Horse_Details.txt", "a") as file:
            file.write(",".join(headers) + "\n")  # Writing headers to the file
            for details in list_of_inputs:
                details_str = ", ".join(f"{header}: {value}" for header, value in
zip(headers, details))
                file.write(details_str + "\n")
                file.write("-" * 120 + "\n")
        print("\tData saved successfully!")
    except Exception as e:
        print(f"Error saving data: {e}")


def print_selected_horses(headers, selected_horses):  # Function to print selected
horses for the major round
    print("\n\t\tSelected Horses for the Major Round\n")
    print("\t".join(headers))
    for horse_details in selected_horses:
        print_details_table(headers, [horse_details])

def sdd(): # Function to select horses randomly for the major round
    global list_of_inputs
    global race_started
    # Check if there are enough horses
    if len(list_of_inputs) < 20:
        print("Not enough horses to proceed with the major round. Please add more
horses.")
        return None
    else:
        race_started = True

    # Organize horses into groups based on a group identifier
    grouped_horses = {}
    for horse_details in list_of_inputs:
        # Assuming 'Group' is at index 6 in the list (adjust based on the actual
structure)
        group_id = horse_details[6]
        if group_id not in grouped_horses:
            grouped_horses[group_id] = []
        grouped_horses[group_id].append(horse_details)

    # Check if there are enough horses in each group
    if any(len(group) < 1 for group in grouped_horses.values()):
        print("Not enough horses in each group to proceed with the major round.
Please add more horses to each group.")
        return
    else:
        race_started = True
```

```
    selected_horses = [random.choice(group) for group in grouped_horses.values()]

    print_selected_horses(headers, selected_horses)
    return selected_horses

winning_horses = []  # New list to store winning horses' details

def whd(selected_horses):  # Function to display winning horses' details
    global winning_horses, TIME_INDEX

    # Check if there are enough horses
    if selected_horses is None or len(selected_horses) < 3:
        print("Not enough horses to determine the top 3 winners.")
        return

    # Assign a random time between 0 to 90s for each selected horse
    for horse in selected_horses:
        horse.append(round(random.randint(20, 120) / 10) * 10)  # Round to nearest
multiple of 10

    # Define the index for time in the horse details
    TIME_INDEX = len(selected_horses[0]) - 1

    top_3_winners = selected_horses[:3]
    for horse in selected_horses[3:]:
        if len(horse) > TIME_INDEX and len(top_3_winners[0]) > TIME_INDEX:
            if horse[TIME_INDEX] < top_3_winners[0][TIME_INDEX]:
                top_3_winners[2] = top_3_winners[1]
                top_3_winners[1] = top_3_winners[0]
                top_3_winners[0] = horse
            elif horse[TIME_INDEX] < top_3_winners[1][TIME_INDEX]:
                top_3_winners[2] = top_3_winners[1]
                top_3_winners[1] = horse
            elif horse[TIME_INDEX] < top_3_winners[2][TIME_INDEX]:
                top_3_winners[2] = horse
        else:
            print("Not enough elements in horse details to access TIME_INDEX.")
            print("Horse details:", horse)

    # Display the details of the top 3 winners with their times
    if TIME_INDEX is not None:
        print_top_3_winners_with_times(headers, top_3_winners)

    # Save the winning horses
    winning_horses = top_3_winners


def print_top_3_winners_with_times(headers, top_3_winners):
    print("\nTop 3 Winners:")
    print("{:<5} {:<15} {:<10} {:<10}".format("Rank", "Horse", "Time (s)", "Time"))
# Adjust format based on your data structure

    # Manually find the winners in ascending order by rank
    rank_1, rank_2, rank_3 = None, None, None
    for winner in top_3_winners:
        if rank_1 is None or winner[TIME_INDEX] < rank_1[TIME_INDEX]:
            rank_3 = rank_2
            rank_2 = rank_1
            rank_1 = winner
        elif rank_2 is None or winner[TIME_INDEX] < rank_2[TIME_INDEX]:
```

```
            rank_3 = rank_2
            rank_2 = winner
        elif rank_3 is None or winner[TIME_INDEX] < rank_3[TIME_INDEX]:
            rank_3 = winner

    for rank, winner in enumerate([rank_1, rank_2, rank_3], start=1):
        print("{:<5} {:<15} {:<10} {:<10}".format(rank, winner[0],
winner[TIME_INDEX], convert_to_seconds(winner[TIME_INDEX])))

def convert_to_seconds(time_in_seconds):
    return f"{time_in_seconds} s"


def vwh():
    global winning_horses, TIME_INDEX

    if TIME_INDEX is None or not winning_horses:
        print("No winning horses data available. Please run the WHD (Display Winning
Horses) option first.")
        return

    for i in range(len(winning_horses)):
        for j in range(i + 1, len(winning_horses)):
            if winning_horses[j][TIME_INDEX] < winning_horses[i][TIME_INDEX]:
                # Swap the horses if the j-th horse finished earlier than the i-th
horse
                winning_horses[i], winning_horses[j] = winning_horses[j],
winning_horses[i]

    # Display the details of the top 3 winning horses
    print("\nVisualization of Winning Horses:")
    for rank, horse in enumerate(winning_horses, start=1):
        time_in_seconds = horse[TIME_INDEX]
        stars = '*' * (time_in_seconds // 10)  # One '*' for every 10 seconds
        print(f"Horse ID: {horse[0]}, {horse[1]}: {stars} {time_in_seconds}s
({rank}st Place)")


def esc():
    print("Exiting the program.")

race_started = False  # Add this line to initialize the variable

while True:
    print("""
            \n\t\t\t\t\t\t Menu
            \n\t\tType AHD for adding horse details
            \tType UHD for updating horse details
            \tType DHD for deleting horse details
            \tType VHD for viewing the registered horses' details table
            \tType SHD for saving the horse details to the text file
            \tType SDD for selecting four horses randomly for the major round
            \tType WHD for displaying the winning horses' details
            \tType VWH for visualizing the time of the winning horses
            \tType ESC to exit the program
        """)
    opt = input("\n\tType the option you want : ")
    opt = opt.upper()

    if opt == 'AHD' and not race_started:
```

```
        ahd()
    elif opt == 'UHD' and not race_started:
        uhd()
    elif opt == 'DHD' and not race_started:
        dhd()
    elif opt == 'VHD':
        vhd()
    elif opt == 'SHD' and not race_started:
        shd()
    elif opt == 'SDD' and not race_started:
        selected_horses = sdd()
    elif opt == 'WHD':
        whd(selected_horses)
    elif opt == 'VWH':
        vwh()
    elif opt == 'ESC':
        esc()
        break
    else:
        print("\nInvalid option, Enter a valid option again")
        continue
```

Description for each function

1. AHD

AHD function is used to input details about the horse, such as ID, name, jockey's name, age, breed, race records (number of wins and total races), and group classification. When the user enters the unique horse_id, the user can easily move on to the next step. The function utilizes a helper function `is_duplicate_horse_id` to check for duplicate horse IDs. After that the user can input horse's name, jockey's name, age, breed, race records, and the group in order. The entered details are stored in a list named `list_of_inputs`. The code includes error handling for invalid inputs and provides success messages upon successful data entry. When all the inputs were entered AHD function is over for the moment and again prints the Main menu.

2. UHD

UHD function is used to update horse details. It asks the user to input the horse_id to be updated, validates the input, and removes the corresponding horse from a global list of inputs. The code again askes the user to input ID, name, jockey's name, age, breed, race records, and group in order. After the data entering, it displays a success message upon successful data entry, and appends the updated information to the list. When all the inputs were entered UHD function is over for the moment and again prints the Main menu.

3. DHD

DHD function is used to delete horse records from a list of inputs. The function utilizes a global variable named `list_of_inputs`, presumably containing details about horses. The program askes the horse_id that should be deleted from the list of inputs from the user. Once a valid Horse ID is provided, the code prints a success message, indicating that the corresponding record has been deleted from the list_of_inputs. The deletion is achieved by creating a new list, excluding the record with the specified Horse ID. When the DHD function is over for the moment and again prints the Main menu.

4. **VHD**

VHD function is used to display the horse details in the list of inputs. Two functions related to managing and displaying horse details. The `print_details_table` function takes two parameters, `headers` and `data`, representing the column headers and corresponding data for horse details. In VHD function appears to use basic bubble sort algorithm to sort the list of inputs based on the horse ID. The sorted details are printed using the `print_details_table` function. When both functions are over for the moment and again print the Main menu.

5. **SHD**

SHD function is designed to save horse details to a text file named "Horse_Details.txt". It begins by opening the file in append mode and writes a line containing headers separated by commas. Subsequently, it iterates through a list of inputs (`list_of_inputs`), where each input corresponds to details about a horse. Finally, the function prints a message indicating whether the data was saved successfully or if an error occurred during the process, providing an error message in the latter case. When the SHD function is over for the moment again prints the Main menu.

6. **SDD**

Two functions related to selecting horses for a major round. The SDD function randomly selects horses for the major round from a global `list_of_inputs`. It checks if there are at least 20 horses in the list first, if not, it prints a message indicating the need to add more horses. Then, it organizes the horses into groups based on a group identifier and ensures that each group has at least one horse and selects one horse randomly from each group. The `print_selected_horses ()` function is called to display the selected horses in a formatted table. The code includes a global variable `race_started` which checks that the race can be started or not. When the both functions are over for the moment again print the Main menu.

7. **WHD**

The WHD function simulates a horse race with a variable number of horses represented by their details. It takes a list of selected horse, assigns random race times to each horse, and then determines the top three winners based on their race times. The winning horses' details, including their ranks and race times, are displayed and stored in the `winning_horses` list. The code includes with error handling for cases where are not enough horses or insufficient details in the horse details. A function

called `convert_to_seconds` is used for consistent time representation. When the WHD function is over for the moment again prints the Main menu.

8. VWH

VWH function visualizes and ranks winning horses based on their finishing times. The function utilizes two global variables, `winning_horses` and `TIME_INDEX`. The function first checks if there are valid data if not, prompting the user to run WHD function to display winning horse data. If the data is available, the function sorts the horses based their finishing times in ascending order and it displays a visualization of the top three winning horses, representing each horse with a number of '*' characters proportional to its finishing time in 10-second intervals. The output contains with horse ID, visual representation of time and their rank. When the VWH function is over for the moment again prints the Main menu.

9. ESC

This Python code defines a function named "esc" that prints the string "Exiting the program." to the console. The function does not take any arguments nor does it return any values. It is assumed that there is additional code outside of this function that calls it when needed.

10. Main menu

This Python code defines a menu system for a horse racing program. It repeatedly prompts the user to select options from the menu until they choose to exit. The code checks the user's input and calls the corresponding functions based on the selected option. It also keeps track of whether the race has started using a flag variable. Certain options are only available before the race starts, and the code handles that restriction. Overall, this code provides a user-friendly way to manage horse racing details and perform various operations on them.

Test cases and plans

Test case	Inputs	Expected output	Actual output	Remarks
1	AHD, 001, Keni, Menya, 5, Appaloosa, 10, 15, A	Data entered successfully Main menu	Data entered successfully Main menu	PASS
2	AHD, 001	Duplicate input. HorseID should be unique.	Duplicate input. HorseID should be unique.	PASS
3	UHD, 001, 001, Buwi, Menya, 5, Appaloosa, 10, 15, A	User is asked to enter the horse details again Main menu	User is asked to enter the horse details again Main menu	PASS
4	UHD, 003	Invalid input. Enter a valid HorseID	Invalid input. Enter a valid HorseID	PASS
5	DHD, 001	Horse_id deleted successfully Main menu	Horse_id deleted successfully Main menu	PASS
6	DHD, 001	Invalid input. Please enter a valid HorseID	Invalid input. Please enter a valid HorseID	PASS
7	VHD	Shows a list of horse details Main menu	Shows a list of horse details Main menu	PASS
8	SHD	Data saved successfully Main menu	Data saved successfully Main menu	PASS
9	SDD	Not enough horses to proceed with the major round. Please add more horses. Main menu	Not enough horses to proceed with the major round. Please add more horses. Main menu	PASS
10	SDD	Select four horses for the major round (One horse from each group) Main menu	Select four horses for the major round (One horse from each group) Main menu	PASS
11	AHD	Invalid option, enter a valid option again (SDD is almost called in the program and there are enough horses to start the race) Main menu	Invalid option, enter a valid option again (SDD is almost called in the program and there are enough horses to start the race) Main menu	PASS

12	WHD	Shows the top three winning horse based on their time in the ascending order. Main menu	Shows the top three winning horse based on their time in the ascending order. Main menu	PASS
13	VWH	Shows the visualization of the top three winning horses based on their time Main menu	Shows the visualization of the top three winning horses based on their time Main menu	PASS
14	ESC	Exiting the program	Exiting the program	PASS
15	EVC	Invalid option, Enter a valid option again Main menu	Invalid option, Enter a valid option again Main menu	PASS

Figure 9 Test case 1

```
                                        Menu

              Type AHD for adding horse details
              Type UHD for updating horse details
              Type DHD for deleting horse details
              Type VHD for viewing the registered horses' details table
              Type SHD for saving the horse details to the text file
              Type SDD for selecting four horses randomly for the major round
              Type WHD for displaying the winning horses' details
              Type VWH for visualizing the time of the winning horses
              Type ESC to exit the program


       Type the option you want : AHD
              Enter the horse's ID                    : 001
              Duplicate input. HorseID should be unique.
              Enter the horse's ID                    :
```

Figure 10 Test case 2

```
                                        Menu

              Type AHD for adding horse details
              Type UHD for updating horse details
              Type DHD for deleting horse details
              Type VHD for viewing the registered horses' details table
              Type SHD for saving the horse details to the text file
              Type SDD for selecting four horses randomly for the major round
              Type WHD for displaying the winning horses' details
              Type VWH for visualizing the time of the winning horses
              Type ESC to exit the program


       Type the option you want : UHD
Enter the Horse ID to Update: 001
              Enter the horse's ID                    : 001
              Enter the horse's name                  : Buwi
              Enter the jockey's name                 : Menya
              Enter the horse's age                   : 5
              Enter the horse's breed                 : Appaloosa
              Enter the number of times horse won             : 10
              Enter the number of times horse ran             : 15
              Enter the horse's group (A, B, C, D)    : A
              Data entered successfully


                                        Menu

              Type AHD for adding horse details
              Type UHD for updating horse details
              Type DHD for deleting horse details
              Type VHD for viewing the registered horses' details table
              Type SHD for saving the horse details to the text file
              Type SDD for selecting four horses randomly for the major round
              Type WHD for displaying the winning horses' details
              Type VWH for visualizing the time of the winning horses
              Type ESC to exit the program


       Type the option you want :
```

Figure 11 Test case 3

```
                                        Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want : UHD
Enter the Horse ID to Update: 003
Invalid input. Please enter a valid Horse ID.
Enter the Horse ID to Update:
```

Figure 12 Test case 4

```
                                        Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want : DHD
Enter the Horse ID to Delete: 001
Horse_id deleted successfully


                                        Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want :
```

Figure 13 Test case 5

```
                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


      Type the option you want : DHD
Enter the Horse ID to Delete: 001
Invalid input. Please enter a valid Horse ID.
Enter the Horse ID to Delete:
```

Figure 14 Test case 6

```
                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


      Type the option you want : VHD
Horse details sorted by Horse ID:
Horse ID: 1, Horse Name: Buwi, Jockey Name: Menya, Age: 5, Breed: Appaloosa, Wins and Runs: (10, 15), Group: A,
-------------------------------------------------------------------------------------------------------------------
Horse ID: 2, Horse Name: Papi, Jockey Name: John, Age: 10, Breed: Appaloosa, Wins and Runs: (16, 20), Group: B,
-------------------------------------------------------------------------------------------------------------------




                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


      Type the option you want :
```

Figure 15 Test case 7

```
                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


    Type the option you want : SHD
    Data saved successfully!


                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


    Type the option you want :
```

Figure 16 Test case 8

```
                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


    Type the option you want : SDD
Not enough horses to proceed with the major round. Please add more horses.


                                        Menu

            Type AHD for adding horse details
            Type UHD for updating horse details
            Type DHD for deleting horse details
            Type VHD for viewing the registered horses' details table
            Type SHD for saving the horse details to the text file
            Type SDD for selecting four horses randomly for the major round
            Type WHD for displaying the winning horses' details
            Type VWH for visualizing the time of the winning horses
            Type ESC to exit the program


    Type the option you want :
```

Figure 17 Test case 9

```
       Type the option you want : SDD

               Selected Horses for the Major Round

Horse ID        Horse Name      Jockey Name     Age     Breed   Wins and Runs   Group
Horse ID: 9, Horse Name: Kin, Jockey Name: Robert, Age: 7, Breed: Akhal Teke, Wins and Runs: (6, 10), Group: A,
-------------------------------------------------------------------------------------------------------------------
Horse ID: 2, Horse Name: Papi, Jockey Name: John, Age: 10, Breed: Appaloosa, Wins and Runs: (16, 20), Group: B,
-------------------------------------------------------------------------------------------------------------------
Horse ID: 125, Horse Name: Den, Jockey Name: Krish, Age: 12, Breed: Paint Horse, Wins and Runs: (42, 52), Group: C,
-------------------------------------------------------------------------------------------------------------------
Horse ID: 102, Horse Name: Yin, Jockey Name: Kim Nam, Age: 14, Breed: Paint Horse, Wins and Runs: (23, 30), Group: D,
-------------------------------------------------------------------------------------------------------------------


                                          Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want :
```

Figure 18 Test case 10

```
                                          Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want : AHD

Invalid option, Enter a valid option again


                                          Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want :
```

Figure 19 Test case 11

```
        Type the option you want : WHD

Top 3 Winners:
Rank  Horse           Time (s)   Time
1     2               60         60 s
2     125             70         70 s
3     9               100        100 s


                                              Menu

                Type AHD for adding horse details
                Type UHD for updating horse details
                Type DHD for deleting horse details
                Type VHD for viewing the registered horses' details table
                Type SHD for saving the horse details to the text file
                Type SDD for selecting four horses randomly for the major round
                Type WHD for displaying the winning horses' details
                Type VWH for visualizing the time of the winning horses
                Type ESC to exit the program


        Type the option you want :
```

Figure 20 Test case 12

```
       Type the option you want : VWH

Visualization of Winning Horses:
Horse ID: 2, Papi: ****** 60s (1st Place)
Horse ID: 125, Den: ******* 70s (2st Place)
Horse ID: 9, Kin: ********** 100s (3st Place)


                                            Menu

               Type AHD for adding horse details
               Type UHD for updating horse details
               Type DHD for deleting horse details
               Type VHD for viewing the registered horses' details table
               Type SHD for saving the horse details to the text file
               Type SDD for selecting four horses randomly for the major round
               Type WHD for displaying the winning horses' details
               Type VWH for visualizing the time of the winning horses
               Type ESC to exit the program


       Type the option you want :
```

Figure 21 Test case 13

```
        Type the option you want : ESC
Exiting the program.

C:\Users\Sandothmi\Desktop\2330912_20230437_Gihanga_CM1601_ICW>
```

Figure 22 Test case 14

```
        Type the option you want : EVC

Invalid option, Enter a valid option again


                                                Menu

                Type AHD for adding horse details
                Type UHD for updating horse details
                Type DHD for deleting horse details
                Type VHD for viewing the registered horses' details table
                Type SHD for saving the horse details to the text file
                Type SDD for selecting four horses randomly for the major round
                Type WHD for displaying the winning horses' details
                Type VWH for visualizing the time of the winning horses
                Type ESC to exit the program


        Type the option you want :
```

Figure 23 Test case 15

Assumptions

1. **Horse_id**

I assumed that horse ID should be three-digit number and also should be unique to each other horse IDs.

2. **Horse age**

I assumed that the horse age should be between 3 to 25 because an average horse lives up to 25 to 30 years.

3. **Race started condition**

When the user enters the SDD function, the program checks whether there are enough horses (at least twenty horses) in the text file or not. If there are not enough horses, the program askes to add more horse details and allows them to run AHD, UHD, and DHD functions. If there are enough horses, the race will start and the program will no longer allow the user to run AHD, UHD, and DHD functions.

4. **Random time index**

The program randomly imports the time for the top three horse in WHD function and in the VWH function, it visualizes the randomly chosen times for the top three horses with stars, using one star to represent each ten seconds. For the ease of visualization, I implemented a method in the WHD function that rounds the randomly choses time to the nearest multiple of ten.

Conclusion

This program is designed to manage the horse race event named ‘Rapid Run’. The program also allows users to update horse details using the options. The program can simulate a major round for selected four horses and shows top three winning horses based on their time to finish the race. This program will be useful for those who do horses races like this.

Reference list

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