Shopping Cart Collecting Route Planner

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1. Requirement

1)A user interface with basic options

2)A map of the lot with a staff shown and several randomly placed carts

3)A solution(not always the best) shown as a route on the map and text directions.

Completed: 1) 2) 3)

2. Additional Requirement

The user could choose to reset the size of the map or the number of the carts.

3.Usage Scenario:

1)starting screen:

```
Welcome!
1) go get carts!
2) settings
3) exit
please choose(1/2/3): 1
```

2）choose 1: start main program

```
please choose(1/2/3): 1
Would you like manual setup or random setup?(m/r)
```

There will be a prompt for choosing setup options: m for manual, r for random

There will be a map of lot:

```
Would you like manual setup or random setup?(m/r)r
    0   1   2   3   4
  +---+---+---+---+---+
 0|     C             |
 1|                 W |
 2|         C         |
 3| C           C     |
 4|                   |
  +---+---+---+---+---+

1)pick up carts in random order
2)pick up carts in an optimal order
please choose(1/2):2
```

S: staff, in the left upper corner(0,0);
C: Cart, random number normally ranging from 3~8, random location except (0,0);
Lot size:8*8 by default
After providing a map of the lot, the program will ask the user for route searching method,1 for random pickup order; 2 for optimal solution by brute force.

```
1)pick up carts in random order
2)pick up carts in an optimal order
please choose(1/2):2
    0   1   2   3   4
  +---+---+---+---+---+
 0|     C   -   -   | |
 1| |   |   -   -   W |
 2| |   |   C         |
 3| C   -   |   C     |
 4|                   |
  +---+---+---+---+---+
```

Then it will provide another map of the lot with a suggested route to collect all the carts with text direction description.

```
At (1,4), take 1 step(s) up to (0,4)
At (0,4), take 3 step(s) left to (0,1)
Pick up the cart!
At (0,1), take 2 step(s) down to (2,1)
At (2,1), take 1 step(s) right to (2,2)
Pick up the cart!
At (2,2), take 1 step(s) down to (3,2)
At (3,2), take 1 step(s) right to (3,3)
Pick up the cart!
At (3,3), take 3 step(s) left to (3,0)
Pick up the cart!
At (3,0), take 2 step(s) up to (1,0)
At (1,0), take 4 step(s) right to (1,4)
route finished!
```

3)choose 2

```
please choose(1/2/3): 2
1)size
2)number of carts
3)back to the main menu
please choose(1/2/3):
```

Choose 1 to reset the size of the map and 2 to reset the number of carts.

```
Welcome!
1) go get carts!
2) settings
3) exit
please choose(1/2/3): 2
1)size
2)number of carts
3)back to the main menu
please choose(1/2/3): 1
please choose a size(5~25):10
1)size
2)number of carts
3)back to the main menu
please choose(1/2/3): 2
please choose a number(3~10):8
1)size
2)number of carts
3)back to the main menu
please choose(1/2/3):
```

We set the size of the map to be 10 and the number of carts to be 8.
After resetting this parameters, this time we choose manual setup:

```
1)size
2)number of carts
3)back to the main menu
please choose(1/2/3): 3
Welcome!
1) go get carts!
2) settings
3) exit
please choose(1/2/3): 1
Would you like manual setup or random setup?(m/r)m
Manually set up the chessboard.
Enter the coordinates of the worker (row, column) separated by a space:
```

The location of the worker and the cart share the input format which is two numbers separated by a space.

```
Enter the coordinates of the worker (row, column) separated by a space: 3 6
   0   1   2   3   4   5   6   7   8   9
 +---+---+---+---+---+---+---+---+---+---+
0|                                       |
1|                                       |
2|                                       |
3|                       W               |
4|                                       |
5|                                       |
6|                                       |
7|                                       |
8|                                       |
9|                                       |
 +---+---+---+---+---+---+---+---+---+---+

Enter the coordinates of cart 1 (row, column) separated by a space:
```

```
Enter the coordinates of cart 1 (row, column) separated by a space: 3 5
   0   1   2   3   4   5   6   7   8   9
 +---+---+---+---+---+---+---+---+---+---+
0|                                       |
1|                                       |
2|                                       |
3|                   C   W               |
4|                                       |
5|                                       |
6|                                       |
7|                                       |
8|                                       |
9|                                       |
 +---+---+---+---+---+---+---+---+---+---+

Enter the coordinates of cart 2 (row, column) separated by a space: 4 7
   0   1   2   3   4   5   6   7   8   9
 +---+---+---+---+---+---+---+---+---+---+
0|                                       |
1|                                       |
2|                                       |
3|                   C   W               |
4|                           C           |
5|                                       |
6|                                       |
7|                                       |
8|                                       |
9|                                       |
 +---+---+---+---+---+---+---+---+---+---+

Enter the coordinates of cart 3 (row, column) separated by a space:
```

After setting all of the 8 carts, we get a final diagram:

```
   0   1   2   3   4   5   6   7   8   9
 +---+---+---+---+---+---+---+---+---+---+
0|                                       |
1|                   C       C           |
2|                                       |
3|                       C   W   C       |
4|     C                         C       |
5|                                       |
6|                                       |
7|         C                             |
8|                                       |
9|                   C                   |
 +---+---+---+---+---+---+---+---+---+---+
```

```
1)pick up carts in random order
2)pick up carts in an optimal order
please choose(1/2):
```

We choose brute force to get the optimal solution.

```
1)pick up carts in random order
2)pick up carts in an optimal order
please choose(1/2):2
    0   1   2   3   4   5   6   7   8   9
  +---+---+---+---+---+---+---+---+---+---+
 0|                                       |
 1|                   C   -   C   |       |
 2|                   |           |       |
 3|                   |   C   W   C       |
 4|     C   -   -     |   |   -   C       |
 5|     |             |                   |
 6|     |             |                   |
 7|     |   C         |                   |
 8|         |         |                   |
 9|         |   -   C                     |
  +---+---+---+---+---+---+---+---+---+---+
```

```
At (3,6), take 1 step(s) left to (3,5)
Pick up the cart!
At (3,5), take 1 step(s) down to (4,5)
At (4,5), take 2 step(s) right to (4,7)
Pick up the cart!
At (4,7), take 1 step(s) up to (3,7)
Pick up the cart!
At (3,7), take 2 step(s) up to (1,7)
At (1,7), take 1 step(s) left to (1,6)
Pick up the cart!
At (1,6), take 2 step(s) left to (1,4)
Pick up the cart!
At (1,4), take 3 step(s) down to (4,4)
At (4,4), take 3 step(s) left to (4,1)
Pick up the cart!
At (4,1), take 3 step(s) down to (7,1)
At (7,1), take 1 step(s) right to (7,2)
Pick up the cart!
At (7,2), take 2 step(s) down to (9,2)
At (9,2), take 2 step(s) right to (9,4)
Pick up the cart!
At (9,4), take 6 step(s) up to (3,4)
At (3,4), take 2 step(s) right to (3,6)
route finished!
```

4.Main Function Code Snippet:

```
def main():
    global lot
    size = 0
    number = 0
    while True:
        print("Welcome!")
        print("1) go get carts!")
        print("2) settings")
        print("3) exit")
        choice = input("please choose(1/2/3): ")
        if choice == "1":
            setup_option = input("Would you like manual setup or random setup?(m/r)")
            # assigned size and cart number
            if size != 0 and number != 0:
                lot = Lot(setup_option, size, number)
            # only assigned size
            elif size != 0:
                lot = Lot(size=size, setup_option=setup_option)
            # only assigned cart number
            elif number != 0:
                lot = Lot(num_carts=number, setup_option=setup_option)
            # no preferred setting
            else:
                lot = Lot(setup_option=setup_option)
            print(lot)
            print("1)pick up carts in random order")
            print("2)pick up carts in an optimal order")
            algo_option=input("please choose(1/2):")
            planner = RoutePlanner(lot,algo_option)
            directions = planner.get_directions(lot)
            lot.add_navigation(directions)
            print(lot)
            lot.print_directions(directions)
        if choice == "2":
            while True:
                print("1)size")
                print("2)number of carts")
                print("3)back to the main menu")
                choice_2 = input("please choose(1/2/3): ")
                if choice_2 == "1":
                    size = int(input("please choose a size(5~25):"))
                elif choice_2 == "2":
                    number = int(input("please choose a number(3~10):"))
                elif choice_2 == "3":
                    break
        if choice == "3":
            break
```