17. Testing

17.1 Black Box Testing:

17.1.1 Functionality: Inputting Search Criteria

Input	Oracle	Output	Pass/Fail
No input for address. Search button is pressed.	Search should not be allowed.	Search blocked. User prompted to enter address: "Please enter the location first!"	Pass
Address input lies outside of Singapore. Input: 20 W 34th St., New York, NY 10001, USA	No location suggestions should appear.	No location suggestions appeared.	Pass
Filter not specified. Address input: Punggol Field, Punggol Plaza, Singapore Search button is pressed.	Search should not be allowed.	Search blocked. User prompted to set filters: "Please set the filter first!"	Pass
Preferred modes of transport not specified. Address input: Punggol Field, Punggol Plaza, Singapore Search button is pressed. Radius: 2 km	Search should not be allowed.	Search blocked. User prompted to set modes of transport: "Please choose at least one mode of transport!"	Pass
No locations found in search radius. Address input: Punggol Field, Punggol Plaza, Singapore Radius: 0.5 km	No search results.	Search blocked. User prompted: "No locations!"	Pass

| Current location is outside of Singapore. Current location button is used. Location used via VPN: Japan | Should not be valid address input. | Location in Japan used as valid address input and marked on map. Able to set filters but no result when searched as no valid locations found in viable search radius. | Fail |

17.1.2 Functionality: Search Results

Input	Oracle	Output	Pass/Fail
Input address itself is a sports location and is the only location in radius. Address input: Toh Yi Drive, Badminton courts @ Toh Yi Drive, Singapore Radius: 0.5 km	Should include input address as result.	Badminton courts @ Toh Yi Drive marked in map with marker. Only Badminton courts @ Toh Yi Drive shows up in result page.	Pass
No valid route for preferred modes of transport. Address input: Pulau Ubin Radius: 8 km	Results with no possible routes should not show up.	Still shows results in search radius that are not reachable with modes of transport. Route display does not show any possible routes. Toggles for modes of transport still present.	Fail

17.1.3 Functionality: Check-In System

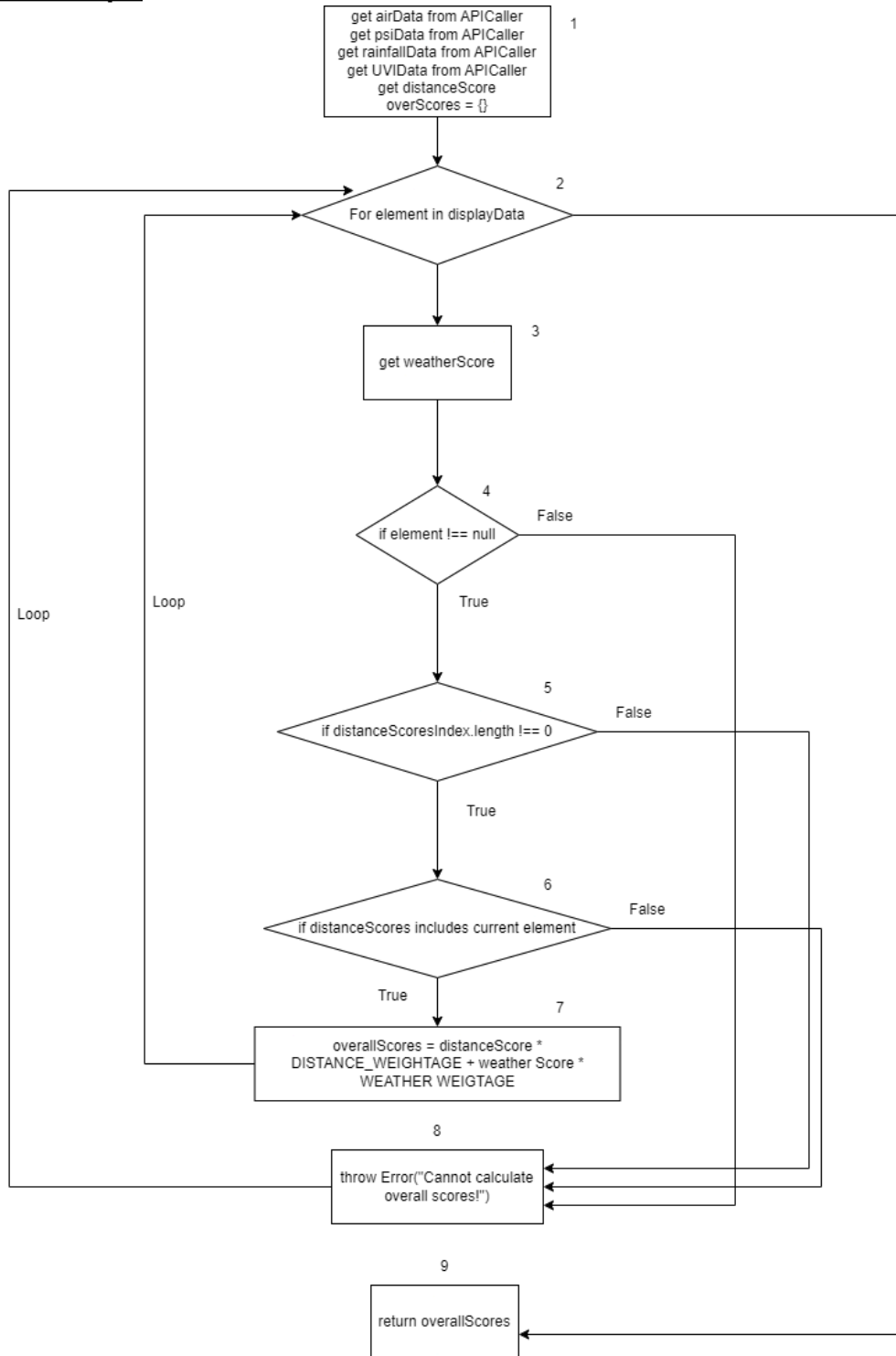| Input	Oracle	Output	Pass/Fail
Status should remain when returning and looking at other locations.	Status remains when returning back to location.	Pre-checked in status still remains when returning to look at other result locations. Pre-checked in status remains when returning to home page and searching with other address inputs and search criteria before returning.	Pass
Status should remain when refreshing page.	Status remains after refreshing page.	Status remains after refreshing page.	Pass
Status should remain after closing page and returning later.	Status remains after reopening page after closing.	Status remains after reopening page after closing.	Pass
User should not be checked-in to multiple locations at once.	User prevented from checking-in to other locations while still checked-in in another location.	User able to be checked-in to multiple locations simultaneously.	Fail
User should not be able to check-in in other locations while "Playing" in another location.	User prevented from checking-in in other locations while still "Playing" in another location.	User able to check-in to other locations while "Playing" in another location.	Fail
User should not be "Playing" in multiple locations at once	User prevented from "Playing" in other locations while still "Playing" in another location.	User able to be "Playing" while "Playing" in another location.	Fail

17.1.3 Functionality: "Help" Button Feedback

Input	Oracle	Output	Pass/Fail
No input for email or feedback.	Feedback should not be sent. User should be prompted to fill up relevant information.	Feedback not sent. User prompted: "Please enter your email and feedback!"	Pass
No email input. Feedback is filled. Feedback: "Great App!"	Feedback should not be sent. User should be prompted to fill up relevant information.	Feedback not sent. User prompted: "Please enter your email and feedback!"	Pass
No feedback input. Email is filled. Email: randall@gmail.com	Feedback should not be sent. User should be prompted to fill up relevant information.	Feedback not sent. User prompted: "Please enter your email and feedback!"	Pass
Invalid email input. Feedback is filled. Email: notarealemail@notarealemail.com Feedback: "Great App!"	Feedback should not be sent. User should be prompted to fill up relevant information properly.	Feedback sent successfully. User prompted: "Feedback sent!" Feedback found in Firebase with invalid email.	Fail

17.2 White Box Testing:

17.2.1: Functionality: calculateScore

Control Flow Graph

```
                          ┌─────────────────────────────┐
                          │  get airData from APICaller  │  1
                          │  get psiData from APICaller  │
                          │ get rainfallData from APICaller│
                          │  get UVIData from APICaller  │
                          │      get distanceScore       │
                          │       overScores = {}        │
                          └─────────────────────────────┘
                                        │
                                        ▼
                              ◇ For element in displayData ◇  2
                                        │
                                        ▼
                              ┌──────────────────┐  3
                              │  get weatherScore │
                              └──────────────────┘
                                        │
                                        ▼
                              ◇ if element !== null ◇  4    ──False──>
                                        │ True
                                        ▼
                        ◇ if distanceScoresIndex.length !== 0 ◇  5  ──False──>
                                        │ True
                                        ▼
                      ◇ if distanceScores includes current element ◇  6  ──False──>
                                        │ True
                                        ▼
                    ┌─────────────────────────────────┐  7
                    │  overallScores = distanceScore * │
                    │  DISTANCE_WEIGHTAGE + weather Score * │
                    │        WEATHER WEIGTAGE          │
                    └─────────────────────────────────┘
                                        │
                                        ▼
                    ┌─────────────────────────────┐  8
                    │  throw Error("Cannot calculate │
                    │       overall scores!")       │
                    └─────────────────────────────┘
                                        │
                                        ▼
                              ┌──────────────────┐  9
                              │ return overallScores │
                              └──────────────────┘
```

Cyclometric complexity

$$CC\ calculation\ =\ |edges|\ -\ |nodes|\ +\ 2$$
$$=\ 12 - 9 + 2$$
$$=\ 5$$

Basis paths:
- I.   1, 2, 3, 4, 5, 6, 7, 2, 9 (baseline)
- II.   1, 2, 9
- III. 1, 2, 3, 4, 8, 2, 9
- IV.   1, 2, 3, 4, 5, 8, 2, 9
- V.   1, 2, 3, 4, 5, 6, 8, 2, 9

Path	Path Flow	Description of scenario and Basis Path choice
I	1→ 2→ 3→ 4→ 5→ 6→ 7→ 2 (loop until all elements in displayData have been processed) → 9 **(baseline)**	This is the typical execution path that the user will experience when calculateScores is called. Hence this will be the baseline path. Upon deciding the departure location from an address, as well as a search radius as a maximum distance the user would like to travel, sports locations within that selected radius will be added to displayData and appear as map markers as an overlay inside of the polyline radius. calculateScores will then call separate functions to calculate weatherScore and distanceScore for each location in the displayData, before combining them based on weightages to generate a final score. overallScores is an array of final scores for the sports locations inside displayData.
II	1→ 2→ 9	This basis path represents a scenario for a false condition at the first decision point which is the for loop. This is when displayData is empty, i.e. there are no elements inside displayData which means it will not enter the for loop and will return early.
III	1→ 2→ 3→ 4 → 8→ 2→ 9	This basis path represents a scenario for a false condition at the second decision point, for element=== null. This is when sports locations generated and added into displayData are not valid objects and are null. It will then throw an error message and continue the loop with the next sports location.

IV	1→ 2→ 3→ 4→ 5→ 8→ 2→9	This basis path represents a scenario for a false condition at the third decision point, for distanceScoresIndex.length=== 0. This is when sports locations generated and added into displayData and passed into calculateDistanceScores encounters an error resulting in distance scores not being generated and resulting in the distance scores array to be empty. It will then throw an error message and continue the loop with the next sports location.
V	1→ 2→ 3→ 4→ 5→ 6→8→ 2→ 9	This basis path represents a scenario for a false condition at the fourth decision point, for when distanceScores array do not contain the ID of the current sports location. This is when sports locations generated and added into displayData and passed into calculateDistanceScores encounters an error resulting in distance scores being calculated for other sports location which are different and mismatch those in displayData. It will then throw an error message and continue the loop with the next sports location.

Test Cases

Path	Test Case	Values of Test Case	Output
I	Baseline path	displayData = [{Facility : "Park" Images :"https://lh5.googleusercontent.com/p/AF1Qip MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu Pg=w122-h92-k-no" Name : "Hoover Park" Ratings : "4.3" Sports : "running (outdoor)" X : "103.7730586" Y : "1.3438729" distanceFromCenter : 1.9991648496827612	[93, 88, 86]

index
: "111"
},{Facility
:
"Gym and Fitness Centre"
Images
:
"https://lh5.googleusercontent.com/p/AF1QipN
gpEyvSbsBrrWBPVbWJyZ29aXo35ijDgnC3M
Fs=w122-h92-k-no"
Name
:
"Badminton courts @ Toh Yi Drive"
Ratings
:
"3.5"
Sports
:
"badminton (indoor)"
X
:
"103.773527"
Y
:
"1.3386533"
distanceFromCenter
:
1.591955602754787
index
:
"157"
},....]

element = {Facility
: "Park"
Images
:"https://lh5.googleusercontent.com/p/AF1Qip
MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu
Pg=w122-h92-k-no"
Name
: "Hoover Park"
Ratings
: "4.3"
Sports
: "running (outdoor)"

		X : "103.7730586" Y : "1.3438729" distanceFromCenter : 1.9991648496827612 index : "111" } --- distanceScoresIndex.length = 3 distanceScores includes element = True	
II	There are no elements inside displayData	displayData = [] element = null distanceScoresIndex.length = 0 distanceScores includes element = False	(3) "Cannot calculate overall scores!"
III	Sports locations generated and added into displayData are null.	displayData = [{Facility : "Park" Images :"https://lh5.googleusercontent.com/p/AF1Qip MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu Pg=w122-h92-k-no" Name : "Hoover Park" Ratings : "4.3" Sports : "running (outdoor)" X : "103.7730586" Y : "1.3438729" distanceFromCenter : 1.9991648496827612 index : "111" },{Facility : "Gym and Fitness Centre" Images	(3) "Cannot calculate overall scores!"

		: "https://lh5.googleusercontent.com/p/AF1QipN gpEyvSbsBrrWBPVbWJyZ29aXo35ijDgnC3M Fs=w122-h92-k-no" Name : "Badminton courts @ Toh Yi Drive" Ratings : "3.5" Sports : "badminton (indoor)" X : "103.773527" Y : "1.3386533" distanceFromCenter : 1.591955602754787 index : "157" },....] element = null distanceScoresIndex.length = 3 distanceScores includes element = false	
IV	Sports locations passed into calculateDistanceS cores encounters an error resulting in distance scores not being generated.	displayData = [{Facility : "Park" Images :"https://lh5.googleusercontent.com/p/AF1Qip MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu Pg=w122-h92-k-no" Name : "Hoover Park" Ratings : "4.3" Sports : "running (outdoor)" X : "103.7730586"	(3) "Cannot calculate overall scores!"

Y
: "1.3438729"
distanceFromCenter
: 1.9991648496827612
index
: "111"
},{Facility
:
"Gym and Fitness Centre"
Images
:
"https://lh5.googleusercontent.com/p/AF1QipN
gpEyvSbsBrrWBPVbWJyZ29aXo35ijDgnC3M
Fs=w122-h92-k-no"
Name
:
"Badminton courts @ Toh Yi Drive"
Ratings
:
"3.5"
Sports
:
"badminton (indoor)"
X
:
"103.773527"
Y
:
"1.3386533"
distanceFromCenter
:
1.591955602754787
index
:
"157"
},....]

element = {Facility
: "Park"
Images
:"https://lh5.googleusercontent.com/p/AF1Qip
MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu
Pg=w122-h92-k-no"
Name
: "Hoover Park"

		Ratings : "4.3" Sports : "running (outdoor)" X : "103.7730586" Y : "1.3438729" distanceFromCenter : 1.9991648496827612 index : "111" } distanceScoresIndex.length = 0 distanceScores includes element = false	
V	Mismatching sports location IDs between displayData and distanceScores	displayData = [{Facility : "Park" Images :"https://lh5.googleusercontent.com/p/AF1Qip MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu Pg=w122-h92-k-no" Name : "Hoover Park" Ratings : "4.3" Sports : "running (outdoor)" X : "103.7730586" Y : "1.3438729" distanceFromCenter : 1.9991648496827612 index : "111" },{Facility : "Gym and Fitness Centre" Images : "https://lh5.googleusercontent.com/p/AF1QipN gpEyvSbsBrrWBPVbWJyZ29aXo35ijDgnC3M Fs=w122-h92-k-no"	(3) "Cannot calculate overall scores!"

Name
:
"Badminton courts @ Toh Yi Drive"
Ratings
:
"3.5"
Sports
:
"badminton (indoor)"
X
:
"103.773527"
Y
:
"1.3386533"
distanceFromCenter
:
1.591955602754787
index
:
"157"
},....]

---

element = {Facility
: "Park"
Images
:"https://lh5.googleusercontent.com/p/AF1Qip
MQ7vAbm1IccWAw38paO05ofLIQ5HefKZl2nu
Pg=w122-h92-k-no"
Name
: "Hoover Park"
Ratings
: "4.3"
Sports
: "running (outdoor)"
X
: "103.7730586"
Y
: "1.3438729"
distanceFromCenter
: 1.9991648496827612
index
: "111"
}

		distanceScoresIndex.length = 3 distanceScores includes element = True	