Design Specification
JobSeeker
Version 2

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Binding Theory to Practice

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Revision Page

By virtue of submitting this document we electronically sign and date that the work being submitted by all the individuals in the group is their exclusive work as a group and we consent to make available the application developed through [CS] or [SE]-2XB3 project, the reports, presentations, and assignments (not including my name and student number) for future teaching purposes.

First revision:

Senni Tan — Edited the title page and created the contribution table.

Zihao Du — Added the attestation and consent in Revision.

Second revision:

Senni Tan — Edited the contribution table.

Zihao Du— Edited the contribution table.

Wang Wenzhi — Edit the contribution table.

Gengyun Wang — Edited the contribution table.

Contribution Page

Name	Role(s)	Contribution	Comments
Zihao Du	Designer Researcher Designer Tester	Proposal Abstract and motivation Database of jobs SRS Functional requirement Graphing algorithm implementation Client module Unit test for graphing algorithm	
Senni Tan	Designer Tester	Proposal I/O SRS Non-functional requirement Sorting Algorithm Implementation Unit test for sorting algorithm implementation	
Gengyun Wang	Designer Tester	Proposal Prior Work SRS Assumptions, Domain Searching Algorithm Implementation Unit test for searching algorithm implementation	
Wenzhi Wang	Designer Tester	Proposal Reference page SRS Maintenance and Development Data processing implementation Test and modify the client code implementation	

Executive Summary

Contents

1 Description of Modules

2 Detailed description of interfaces

Comparator Module

Module

Comparable

Uses

Job

Syntax

Exported Access Programs

Routine name	In	Out	Exceptions
CompareString	Job, Job	$\mathbb{Z}$	
CompareOutlook	Job, Job	$\mathbb{Z}$	
CompareNOC	Job, Job	$\mathbb{Z}$	
CompareRegionS	Job, Job	$\mathbb{Z}$	

Semantics

Access Routine Semantics

CompareString(a, b):

- output: *out* := a.get_title.compareTo(b.get_title)
- exception: None

// compareTo is a build in method to compare String in lexgraphical order.

CompareOutlook(a, b):

- output: *out* := (a.get_outlook > b.get_outlook) $\Rightarrow$ 1 | (a.get_outlook < b.get_outlook) $\Rightarrow$ -1 | 0
- exception: None

CompareNOC(a, b):

- output: *out* := (a.get_noc(0) > b.get_noc(0)) ⇒ 1 | (a.get_noc(0) < b.get_noc(0)) ⇒ -1 | 0
- exception: None

CompareRegionS(a, b):

- output: *out* := a.get_regions.compareTo(b.get_regions)
- exception: None

// compareTo is a build in method to compare String in lexgraphical order.

Sorting Module

Module

Sorting

Uses

Comparable

Syntax

Exported Access Programs

Routine name	In	Out	Exceptions
sortString	Seq of Job		
sortOutlook	Seq of Job		
sortNOC	Seq of Job		
sortRegionS	Seq of Job		

Semantics

Access Routine Semantics

sortString(a):

- transition: sortString(a, 0, $|a|$-1)
- exception: None

sortOutlook(a):

- transition: sortOutlook(a, 0, $|a|$-1)
- exception: None

sortNOC(a):

- transition: sortNOC(a, 0, $|a|$-1)
- exception: None

sortRegionS(a):

- transition: sortRegionS(a, 0, $|a|$-1)
- exception: None

Local Functions

exch: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
exch$(a, i, j) \equiv$ exchange a[i] and a[j] in the array

sortString: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
sortString$(a, lo, hi) \equiv$ (hi <= lo) $\Rightarrow$ return | sortString(a, lo, j-1) && sortString(a, j+1, hi) where j = partitionString(a, lo, hi)

partitionString: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
partitionString$(a, lo, hi) \equiv$ partition on array a using ComapreString, see detail in code

sortOutlook: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
sortOutlook$(a, lo, hi) \equiv$ (hi <= lo) $\Rightarrow$ return | sortOutlook(a, lo, j-1) && sortOutlook(a, j+1, hi) where j = partitionOutlook(a, lo, hi)

partitionOutlook: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
partitionOutlook$(a, lo, hi) \equiv$ partition on array a using ComapreOutlook, see detail in code

sortNOC: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
sortNOC$(a, lo, hi) \equiv$ (hi <= lo) $\Rightarrow$ return | sortNOC(a, lo, j-1) && sortNOC(a, j+1, hi) where j = partitionNOC(a, lo, hi)

partitionNOC: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
partitionNOC$(a, lo, hi) \equiv$ partition on array a using ComapreNOC, see detail in code

sortRegionS: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
sortRegionS$(a, lo, hi) \equiv$ (hi <= lo) $\Rightarrow$ return | sortRegionS(a, lo, j-1) && sortRegionS(a, j+1, hi) where j = partitionRegionS(a, lo, hi)

partitionRegionS: Seq of Job $\times \mathbb{Z} \times \mathbb{Z} \rightarrow$ None
partitionRegionS$(a, lo, hi) \equiv$ partition on array a using ComapreRegionS, see detail in code

Graph Module

Module

Graph

Uses

N/A

Syntax

Exported Constants

None

Exported Types

Graph = ?
//An undirected graph with unweighed edges

Exported Access Programs

Routine name	In	Out	Exceptions
Graph	$\mathbb{Z}$	Graph	NegativeArraySizeException
addedge	$\mathbb{N}$, $\mathbb{N}$		IllegalArgumentException
V		$\mathbb{N}$	
E		$\mathbb{N}$	
adj	$\mathbb{N}$	Seq of $\mathbb{N}$	IllegalArgumentException

Semantics

State Variables

V: $\mathbb{N}$
E: $\mathbb{N}$
adj: Seq of Seq of $\mathbb{N}$

State Invariant

None

Assumptions

The constructor Graph is called for each object instance before any other access routine is called for that object. The constructor cannot be called on an existing object.

Access Routine Semantics

//Constructor of Graph class
Graph(v):

- transition: $V, E, adj := v, 0,$ Seq of Seq of $\mathbb{N}$ with length v
- output: $out := self$
- exception: $exc := v < 0 \Rightarrow$ NegativeArraySizeException

//Connect vertex w and vertex v
addedge(w, v):

- transition: $E, adj[w], adj[v] := E + 1, adj[w] \,||\, v, adj[v] \,||\, w$
- exception: $exc := w < 0 \vee w > V \vee v < 0 \vee v \vee V \Rightarrow$ IllegalArgumentException

//Getter, get the number of edges
E():

- output: $out := E$
- exception: None

//Getter, get the number of vertices
V():

- output: $out := V$
- exception: None

//Getter, get a list of nodes that are conneted with vertex v
adj(v):

- output: $out := adj[v]$
- exception: $exc := v < 0 \vee v > V \Rightarrow$ IllegalArgumentException

Graph Module

Module

DFS

Uses

Graph

Syntax

Exported Constants

None

Exported Types

DFS = ?
//Detect the reachable vertices from a source vertex

Exported Access Programs

Routine name	In	Out	Exceptions
DFS	Graph, $\mathbb{N}$	DFS	IllegalArgumentException
hasPathTo	$\mathbb{N}$	$\mathbb{B}$	IllegalArgumentException
count		$\mathbb{N}$	

Semantics

State Variables

count: *mathbbN*
marked: Seq of $\mathbb{B}$

State Invariant

None

Assumptions

The constructor DFS is called for each object instance before any other access routine is called for that object. The constructor cannot be called on an existing object.

Access Routine Semantics

//Constructor of DFS class
Graph(g, s):

- transition: $count$, marked := number of reachable nodes, Seq of $\mathbb{B}$ recording if a vertex is reachable
- output: $out := self$
- exception: $exc := s < 0 \vee s >= g.V() \Rightarrow$ IllegalArgumentException

//Determine if vertex w is reachable from the source vertex
hasPathTo(w):

- output: $out := marked[w]$
- exception: $exc := w < 0 \vee w >= V \Rightarrow$ IllegalArgumentException

//Getter, get the number of reachable vertices
count():

- output: $out := count$
- exception: None

3 View of uses relationship

4 Trace back to requirements

5 Description of implementation

DFS Module

Module

DFS

Uses

Graph

Local Functions

dfs: $Graph \times \mathbb{N}$
//The private dfs method recursively call itself to detect deeper layer of the graph until it hits a sink vertex, then it will turn back to the previous layer and detect again. It updates the state variable "count" and "marked[]" to avoid repeatation of exploration

6 Internal review