CSI - Programming Assignment - 1
Report

Files submitted as a part of this assignment:

- Node.java
- Partition.java
- IslandSurvey.java
- IslandLakeSurvey.java
- Two sample input/output files.
- Other input/output files.
- .class files.
- CSI PA: 1 - Report
- Readme.txt

Partition ADT (Linked-List/Sequence)

- Each cluster in my sequence-based partition is a doubly-linked list of nodes.
- Elem, previous, next, and newNode (back-pointer to its Cluster) are the Node<E> fields that I use in my work.
- A LinkedList<Cluster<E>> of active clusters is maintained by Partition<E>. Head, tail, and counter <size> are stored in each Cluster<E>.
  The methods and their operations are described as follows:
    - makeCluster(x): yields the node of a singleton cluster after creating it (O(1)). The function returns the leader (cluster head) of p find(p) (O(1)).
    - union(p, q): deletes the emptied cluster from the global list (O($\min(n_1, n_2)$)) and combines the two clusters by shifting all nodes from the smaller list to the bigger (append at tail), updating each node's newNode pointer.

Part 2A → IslandSurvey (Islands Only)

- Treat '1' cells as land (black). Create a position for each black cell and union 4-neighbors (up, down, left, right).
- After the initial map and after each phase, print:
    - Number of islands,
    - Island sizes in decreasing order on one line (-1 if none),
    - Total black area.

- Formatting rule: print one blank line between surveys, and none after the last survey.

Part 2B - IslandLakeSurvey (Islands + Lakes)

- Same 4-neighbour unions as Part 2A apply to the black partition.
- White partition: unions of eight neighbors. If a lake is 4-adjacent to exactly one back island and does not touch the boundary, it is considered a white component.
- Add the area of each lake to the island that owns it. Following each survey, print:
    - The quantity of islands.
    - Ultimate island-sized (including lake areas) on a single line in decreasing sequence (-1 for none),
    - Entire island (including lakes),
    - The quantity of lakes,
    - Entire lake area.
    - Part 2A's blank-line rule is the same.

Notes

- Uses LinkedList only (no ArrayList), normal for loops, and normal if statements throughout.
- Handles edge cases: no islands, all land, multiple lakes inside one island, lakes touching border (excluded), etc.

Complexity

- SxT grid size.
- The union based on sequence is $(O(\min(n_1, n_2)))$.
- Overall, initial black unions are $O(S \cdot T)$; unions only happen around modified cells each phase.
- The worst-case scenario is $O(S \cdot T)$ each survey since the white-component scan (for lakes) has a linear grid size per survey.

Resources

- Course assignment handout + appendix on the sequence-based partition ADT.
- Standard Java library only; no external libraries or online code used.
- Used online resources are cited below in APA format.

References

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