



CIS*4720 Image Processing and Vision
Winter 2023, Assignment 3 Part 2/2

Your submission must include the statement below, followed by your signature:

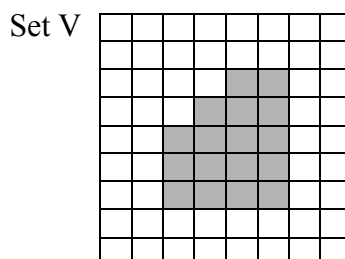
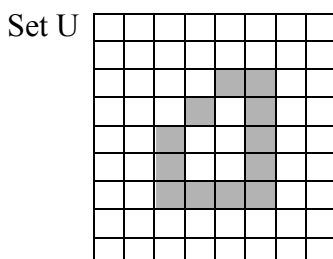
"I have read and understood the Academic Misconduct section in the course outline.

I assert this work is my own."

The sets considered here are subsets of \mathbb{Z}^2 .

Using pseudocode and the library in appendix, write the following functions:

2.
 - a) **boolean are4Connected (element p, element q, set A)**
Returns **true** iff (if and only if) p and q are 4-connected in A.
The number of 4-connected components of A must be finite.
 - b) **boolean is4Connected (set A)**
Returns **true** iff A is 4-connected.
Note that the empty set is 4-connected.
 - c) **boolean are4Adjacent (element p, element q, set A)**
Returns **true** iff p and q are 4-adjacent in A.
 - d) **boolean are4Adjacent (set A, set B)**
Returns **true** iff A and B are 4-adjacent.
The number of 4-connected components of A (resp. B) must be finite.
3.
 - a) **integer numberHoles8 (set A)**
Returns the number of holes of A, where A is considered with 8-connectedness.
See example below. The number of elements of A must be finite.
 - b) **void fillHoles8 (set A)**
See example below. The number of elements of A must be finite.
 - c) **set boundary8 (set A)**
See example below. The number of elements of A must be finite.



numberHoles8(U) returns 1.
fillHoles8(U) changes U to V.
boundary8(V) returns U.

Appendix

set complement (set A)

Returns $\mathbb{Z}^2 - A$.

set union (set A, set B)

Returns $A \cup B$.

set intersection (set A, set B)

Returns $A \cap B$.

set emptySet ()

Returns \emptyset .

set universe ()

Returns \mathbb{Z}^2 .

integer numberElements (set A)

Returns the number of elements of A (returns -1 for infinity).

element elementNumber (integer i, set A)

Returns the i^{th} element of A (with $i \geq 1$).

boolean belongsTo (element p, set A)

Returns **true** iff $p \in A$.

void addToSet (element p, set A)

Changes A to $A \cup \{p\}$.

void subtractFromSet (element p, set A)

Changes A to $A - \{p\}$.

set 4neighbours (element p)

Returns the set of all 4-neighbours of p.

set 8neighbours (element p)

Returns the set of all 8-neighbours of p.

boolean are4Neighbours (element p, element q)

Returns **true** iff p and q are 4-neighbours.

boolean are8Neighbours (element p, element q)

Returns **true** iff p and q are 8-neighbours.

integer number4Components (set A)

Returns the number of 4-connected components of A (returns -1 for infinity).

integer number8Components (set A)

Returns the number of 8-connected components of A (returns -1 for infinity).

set 4componentNumber (integer i, set A)

Returns the i^{th} 4-connected component of A (with $i \geq 1$).

set 8componentNumber (integer i, set A)

Returns the i^{th} 8-connected component of A (with $i \geq 1$).