Program 1

0:

A = {'b', 'c', 'd', 'a'}

B = {'v', 'z', 'x', 'w', 'y'}

f = {('c', 'x'), ('a', 'z'), ('d', 'w'), ('b', 'y')}

This relation is a function.

It is injective.

1:

A = {'b', 'c', 'd', 'a'}

B = {'x', 'z', 'y'}

f = {('c', 'x'), ('a', 'z'), ('b', 'y'), ('d', 'z')}

This relation is a function.

It is surjective.

2:

A = {'b', 'c', 'd', 'a'}

B = {'x', 'w', 'z', 'y'}

f = {('c', 'x'), ('a', 'z'), ('d', 'w'), ('b', 'y')}

This relation is a function.

It is bijective.

The inverse function is:

A = {'x', 'w', 'z', 'y'}

B = {'b', 'c', 'd', 'a'}

f = {('x', 'c'), ('z', 'a'), ('y', 'b'), ('w', 'd')}

3:

A = {'b', 'c', 'd', 'a'}

B = {1, 2, 3, 4, 5}

f = {('c', 1), ('a', 4), ('d', 3), ('b', 5)}

This relation is a function.

It is injective.

4:

A = {'b', 'c', 'a'}

B = {1, 2, 3, 4}

f = {('a', 3), ('c', 1), ('b', 4)}

This relation is a function.

It is injective.

5:

A = {'b', 'c', 'd', 'a'}

B = {1, 2, 3}

f = {('b', 1), ('c', 3), ('d', 2), ('a', 2)}

This relation is a function.

It is surjective.

6:

A = {'b', 'c', 'd', 'a'}

B = {1, 2, 3, 4}

f = {('b', 1), ('a', 4), ('c', 3), ('d', 2)}

This relation is a function.

It is bijective.

The inverse function is:

A = {1, 2, 3, 4}

B = {'b', 'c', 'd', 'a'}

f = {(4, 'a'), (1, 'b'), (3, 'c'), (2, 'd')}

7:

A = {'b', 'c', 'd', 'a'}

B = {1, 2, 3, 4}

f = {('b', 1), ('c', 2), ('d', 3), ('a', 2)}

This relation is a function.

8:

A = {'b', 'c', 'a'}

B = {1, 2, 3, 4}

f = {('b', 1), ('a', 4), ('d', 3), ('a', 2)}

This relation is a function.

It is bijective.

The inverse function is:

A = {1, 2, 3, 4}

B = {'b', 'c', 'a'}

f = {(1, 'b'), (2, 'a'), (4, 'a'), (3, 'd')}

Program 2

puzzle1.txt

5 _ _ _ _ _ 1 7 _

1 _ 6 5 _ 9 _ 4 _

4 7 2 1 _ 6 _ _ _

9 _ _ _ _ _ 5 _ _

_ 1 8 _ 9 5 4 _ _

6 _ _ 4 _ 2 3 8 9

_ 4 _ _ _ _ 9 3 _

_ 9 _ 7 _ 3 _ 5 _

2 6 3 9 5 8 7 1 4

5 2 9 3 6 4 1 7 8

1 8 6 5 7 9 2 4 3

472136895

931847526

318295467

657412389

745681932

894723651

263958714

Soduku2

puzzle2.txt

53_8_4_76

1_6_79_43

_7__36__5

924_8_56_

3_869_427

_5_4123__

745_6_9_8

8_17_3652

_6395_7_4

539824176

186579243

472136895

924387561

3 1 8 6 9 5 4 2 7

6 5 7 4 1 2 3 8 9

7 4 5 2 6 1 9 3 8

8 9 1 7 4 3 6 5 2

2 6 3 9 5 8 7 1 4

puzzle3.txt

7 _ _ 3 _ 6 _ 4 _

3 4 _ 5 _ 9 6 _ 8

6 1 9 8 _ 7 5 2 3

4 9 _ _ 8 5 _ _ 7

1 2 _ _ _ _ 3 6 5

_ 7 6 _ 3 _ 8 _ _

2 _ 1 4 9 _ _ _ 6

_ 3 _ 2 _ 8 4 _ 1

8 6 4 7 _ _ 9 3 2

7 8 5 3 2 6 1 4 9

3 4 2 5 1 9 6 7 8

6 1 9 8 4 7 5 2 3

4 9 3 6 8 5 2 1 7

1 2 8 9 7 4 3 6 5

5 7 6 1 3 2 8 9 4

2 5 1 4 9 3 7 8 6

9 3 7 2 6 8 4 5 1

8 6 4 7 5 1 9 3 2

puzzle4.txt

7 3 2 _ 8 4 6 9 1

9 1 _ 3 _ _ 5 2 _

8 _ _ 9 _ 2 7 3 4

5 4 9 _ _ _ 8 6 3

1 _ _ _ 3 _ 2 _ 7

_ 2 3 _ 4 8 9 1 _

3 9 _ 8 5 _ 4 7 2

_ 7 _ 4 _ 3 _ _ 6

4 6 8 _ 7 _ _ 5 9

No solution

puzzle5.txt

_ _ _ _ _ 4 2 _ 1

_ _ _ _ 7 _ _ _ 5

_ _ 8 1 _ 5 7 _ _

_ 4 1 _ 3 2 8 _ _

3 8 9 _ 5 6 1 2 7

2 _ _ _ _ 8 3 _ _

_ 2 4 _ _ 7 _ 1 _

8 3 6 _ 9 _ 4 _ _

_ _ 7 _ _ 3 5 _ _

6 5 3 7 8 4 2 9 1

4 1 2 3 7 9 6 8 5

9 6 8 1 2 5 7 3 4

7 4 1 6 3 2 8 5 9

3 8 9 4 5 6 1 2 7

2 7 5 9 1 8 3 4 6

5 2 4 8 6 7 9 1 3

8 3 6 5 9 1 4 7 2

1 9 7 2 4 3 5 6 8