Test Suites for Paradise Spatial Objects

Nirupama Chandrasekaran

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1 Introduction

This document specifies the test suites prepared for the five spatial obejects supported in Paradise namely Points, Circles, Closed Polygons, Polylines and Swiss cheese Polygons. The entire test suite is divided into 5 smaller test suites (for roughly each of the spatial objects).

For each spatial object, the following are the files used in it's test suite. (X stands for one of 'point', 'circle', 'polyline', 'closedPolygon' or 'swPolygon'.)

- X.load: Instructions for the client to create a database and load the data file for the test suit into an extent.
- X.query: The test queries. Also has information about the correct result for each query.
- X.dat: The data for the extent created in X.load.
- X.result: The result (generated by the current Paradise version) for the queries in X.query.
- X.idx.load: Creates an index in the spatial data field.
- X.idx.result: The results for the queries in X.query when X.idx.load was used to load the data

2 Test Suites

The postscript version of this document is in /p/paradise/doc/spatial_test.ps. The test suites reside in /p/paradise/para_cvs/test/spatial. The following sections describe the details of the test suite for each of the spatial objects.

2.1 Point

The "Point" test suite has 5 sets of objects. Each set tests points against one of the other spatial objects. The different sets can be recoganised by their ids as follows.

- *0 - 7:* Point - Point tests
- *31 - 36:* Point - Closed Polygon tests
- *61 - 64:* Point - Circle tests
- *91 - 96:* Point - Swiss Cheese Polygon tests
- *121 - 126:* Point - Polyline tests

The following figures each show a point (shown as a X) and the object against which it is being tested (shown in dotted lines). The object id is the number seen on the top left corner of each object. The test queries (point.query) for the point data type are listed after the figures at the end of this section.

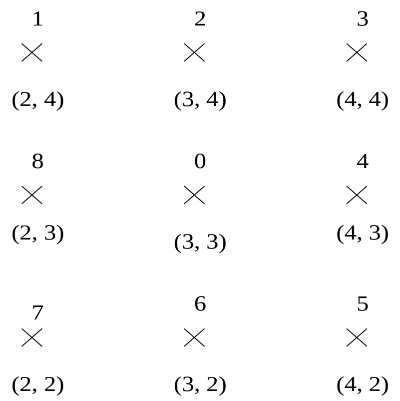


Figure 1: Point - Point Tests

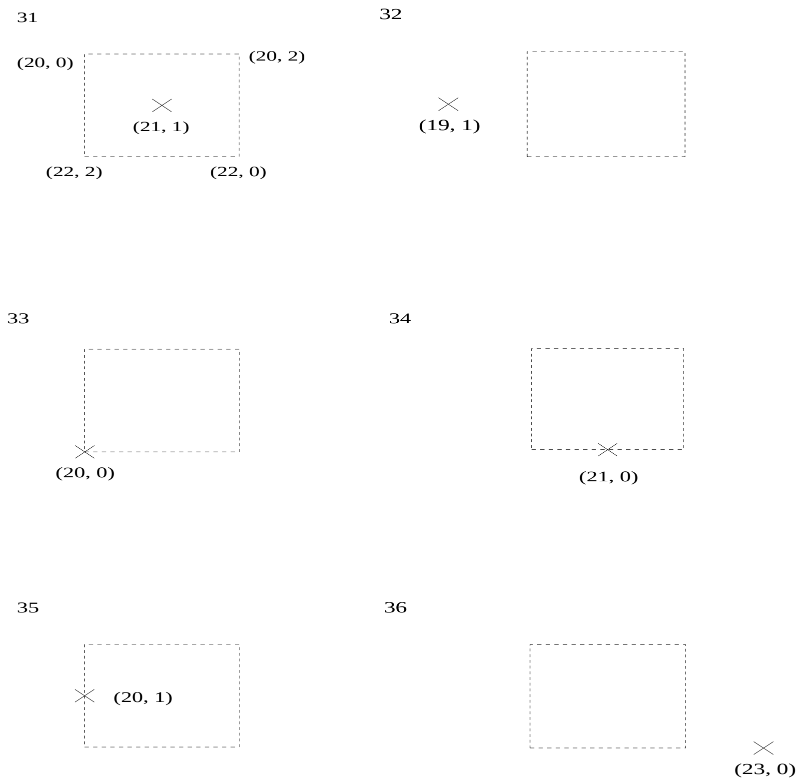


Figure 2: Point - Closed Polygon Tests

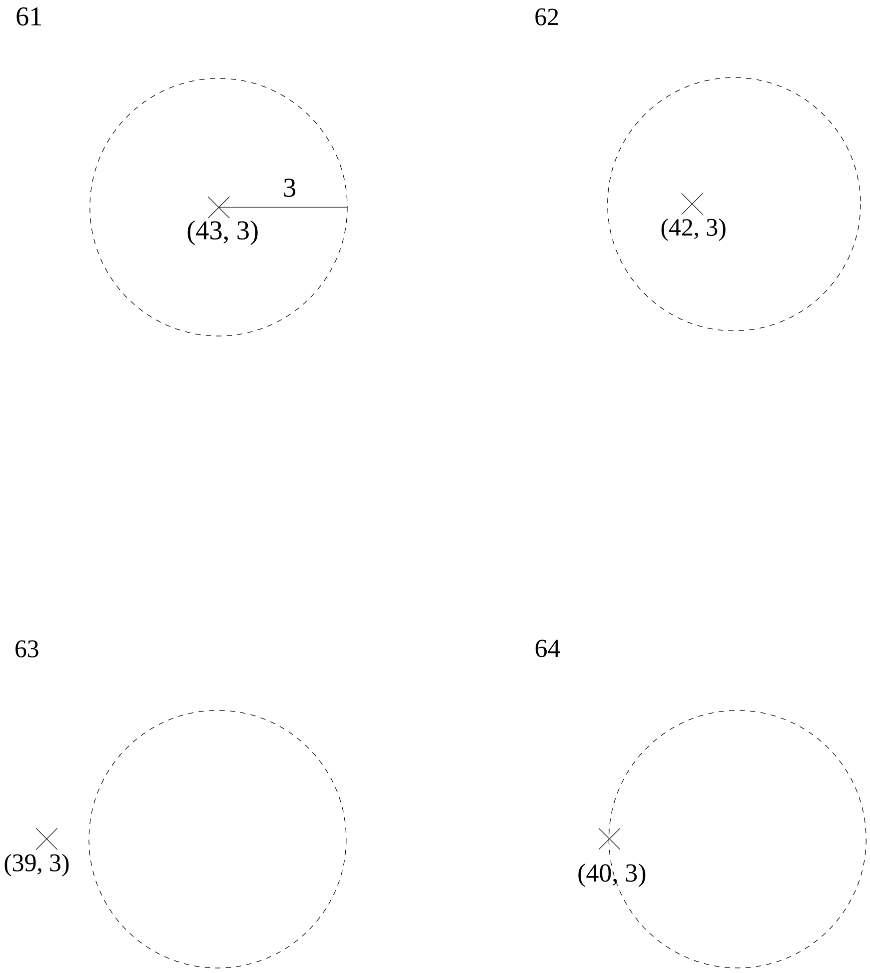


Figure 3: Point - Circle Tests

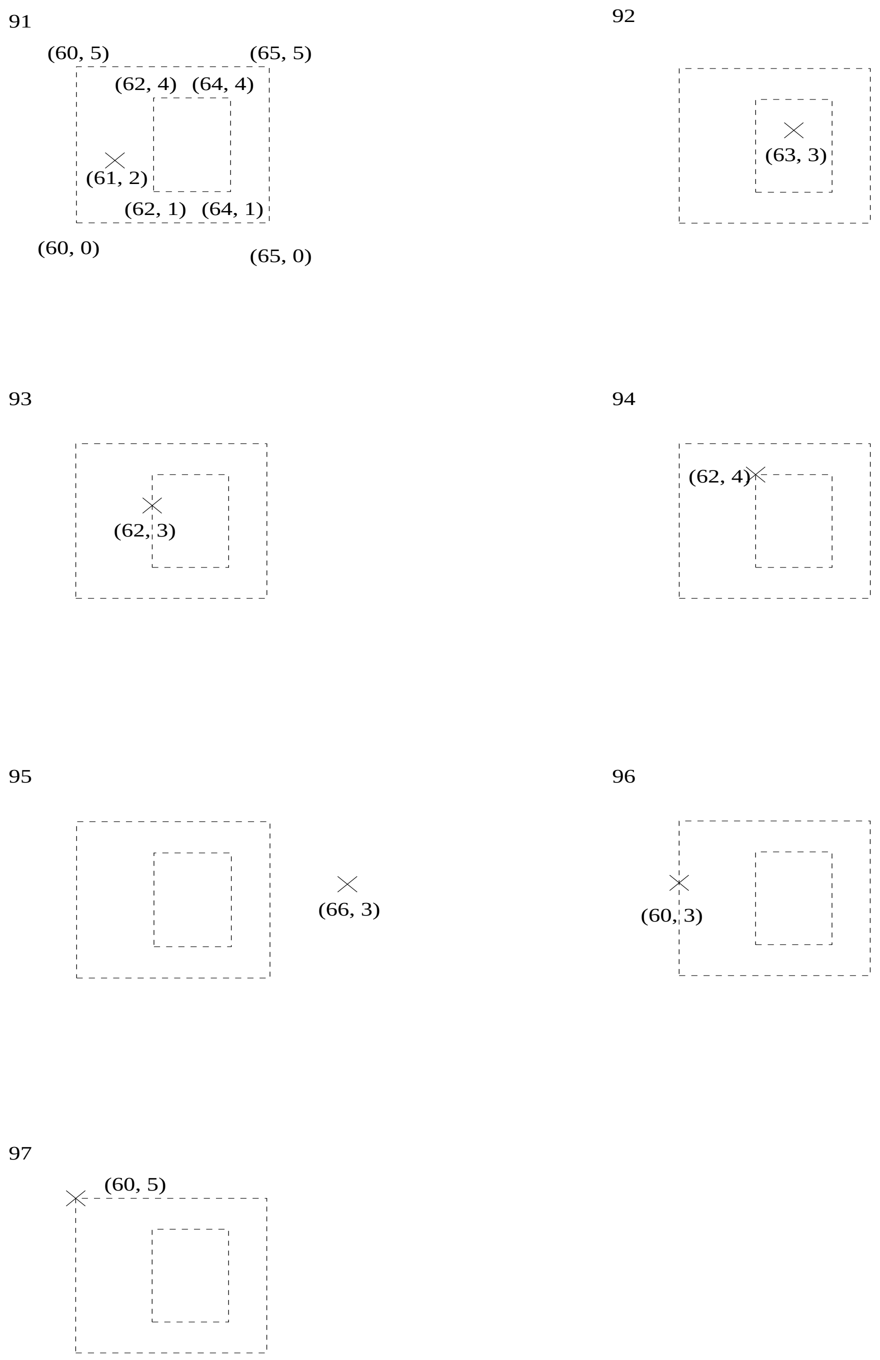


Figure 4: Point - Swiss Cheese Polygon Tests

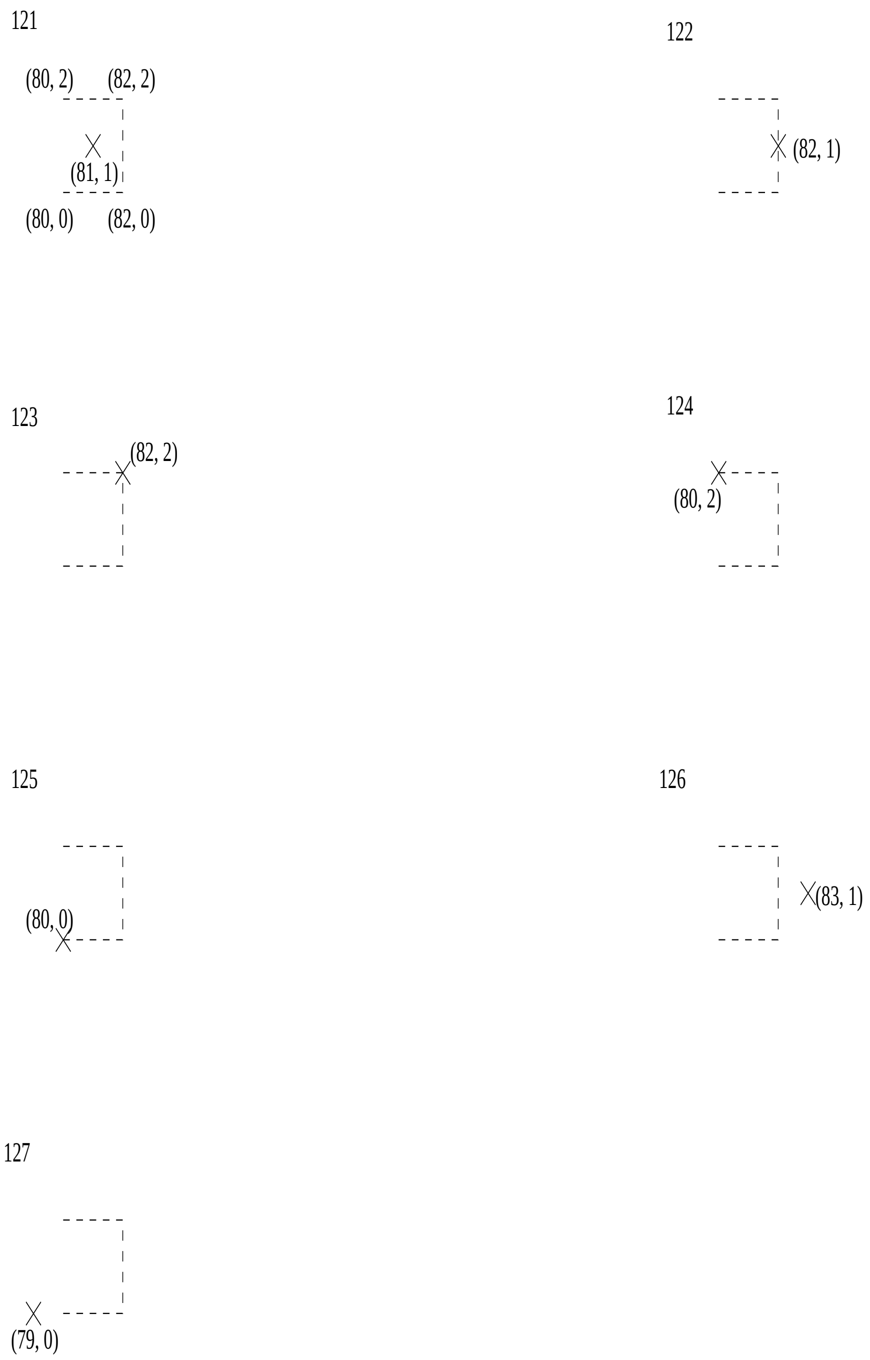


Figure 5: Point - Polyline Tests

```
open db point_test;

// test1
select id
from point
where point.shape = Point (3, 3);
// result : 0


// test2
select id
from point
where point.shape < Point (3, 3);
// reslut : 7


// test3
select id
from point
where point.shape overlaps Point (3, 3);
// result : 0


// test4
select id
from point
where point.shape < ClosedPolygon ("20 0,
                                   20 2,
                                   22 2,
                                   22 0");
// result : 31


// test5
select id
from point
where point.shape overlaps ClosedPolygon ("20 0,
                                          20 2,
                                          22 2,
                                          22 0");
// result : 31, 33, 34, 35
```

```
// test6
select id
from point
where point.shape < Circle (Point (43, 3), 3);
// result : 61, 62


// test7
select id
from point
where point.shape overlaps Circle (Point (43, 3), 3);
// result : 61, 62, 64


// test8
select id
from point
where point.shape < SwCheesePoly("60 0,
                                  60 5,
                                  65 5,
                                  65 0:
                                  62 1,
                                  62 4,
                                  64 4,
                                  64 1");
// result : 91


// test9
select id
from point
where point.shape overlaps SwCheesePoly("60 0,
                                         60 5,
                                         65 5,
                                         65 0:
                                         62 1,
                                         62 4,
                                         64 4,
                                         64 1");
// result : 91, 93, 94, 96, 97
```

```
// test10
select id
from point
where point.shape overlaps PolyLine ("80 0,
                                     80 2,
                                     82 2,
                                     82 0");
// result : 122, 123, 124, 125


close db point_test;
```

2.2 Circle

The "Circle" test suite has only one set of objects (0-6). This set tests a circle against the other circles.

The following figures each show a circle (shown in dotted lines) being tested against other circles. The object id is the number seen on the top left corner of each object. The test queries (circle.query) for the circle data type are listed after the figures at the end of this section.

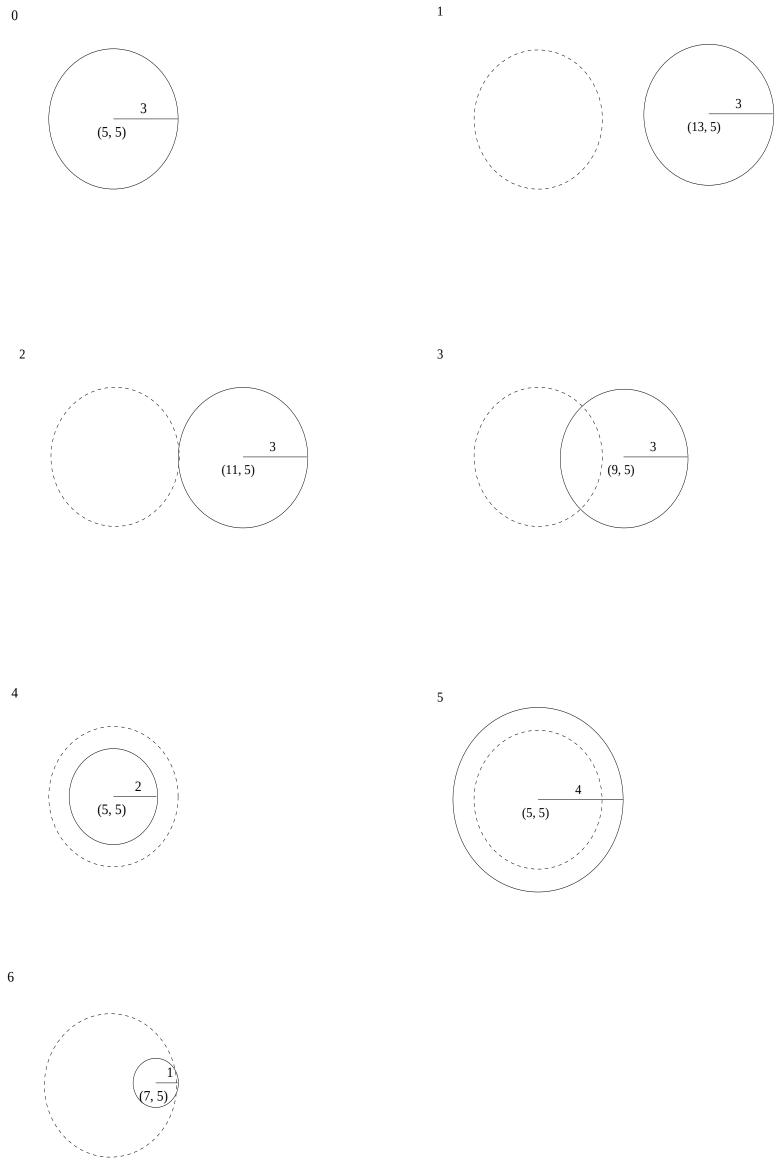


Figure 6: Circle - Circle Tests

```
open db circle_test;

// test1
select id
from circle
where circle.shape = Circle (Point (5, 5), 3);

//result: 0

// test2
select id
from circle
where circle.shape < Circle (Point (5, 5), 3);

//result: 4, 6

// test3
select id
from circle
where circle.shape <= Circle (Point (5, 5), 3);

//result: 0, 4, 6

// test4
select id
from circle
where circle.shape > Circle (Point (5, 5), 3);

//result: 5

// test5
select id
from circle
where circle.shape >= Circle (Point (5, 5), 3);

//result: 0, 5

// test6
select id
from circle
where circle.shape overlaps Circle (Point (5, 5), 3);

//result: 0, 2, 3, 4, 5, 6

close db circle_test;
```

2.3 Polyline

The "Polyline" test suite has 4 sets of objects. Each set tests polylines against one of polylines, polygons, swiss cheese polygons and circles. The different sets can be recoganised by their ids as follows.

- *0 - 2:* Polyline - Polyline tests
- *31 - 38:* Polyline - Polygon tests
- *61 - 67:* Polyline - Swiss Cheese Polygon tests
- *91 - 100:* Polyline - Circle tests

The following figures each show a polyline and the object against which it is being tested (shown in dotted lines). The object id is the number seen on the top left corner of each object. The test queries (polyLine.query) for the polyline data type are listed after the figures at the end of this section.

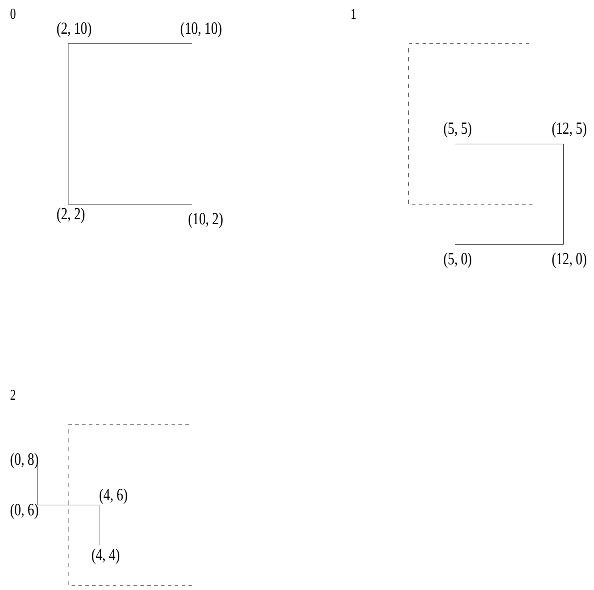


Figure 7: Polyline - Polyline Tests

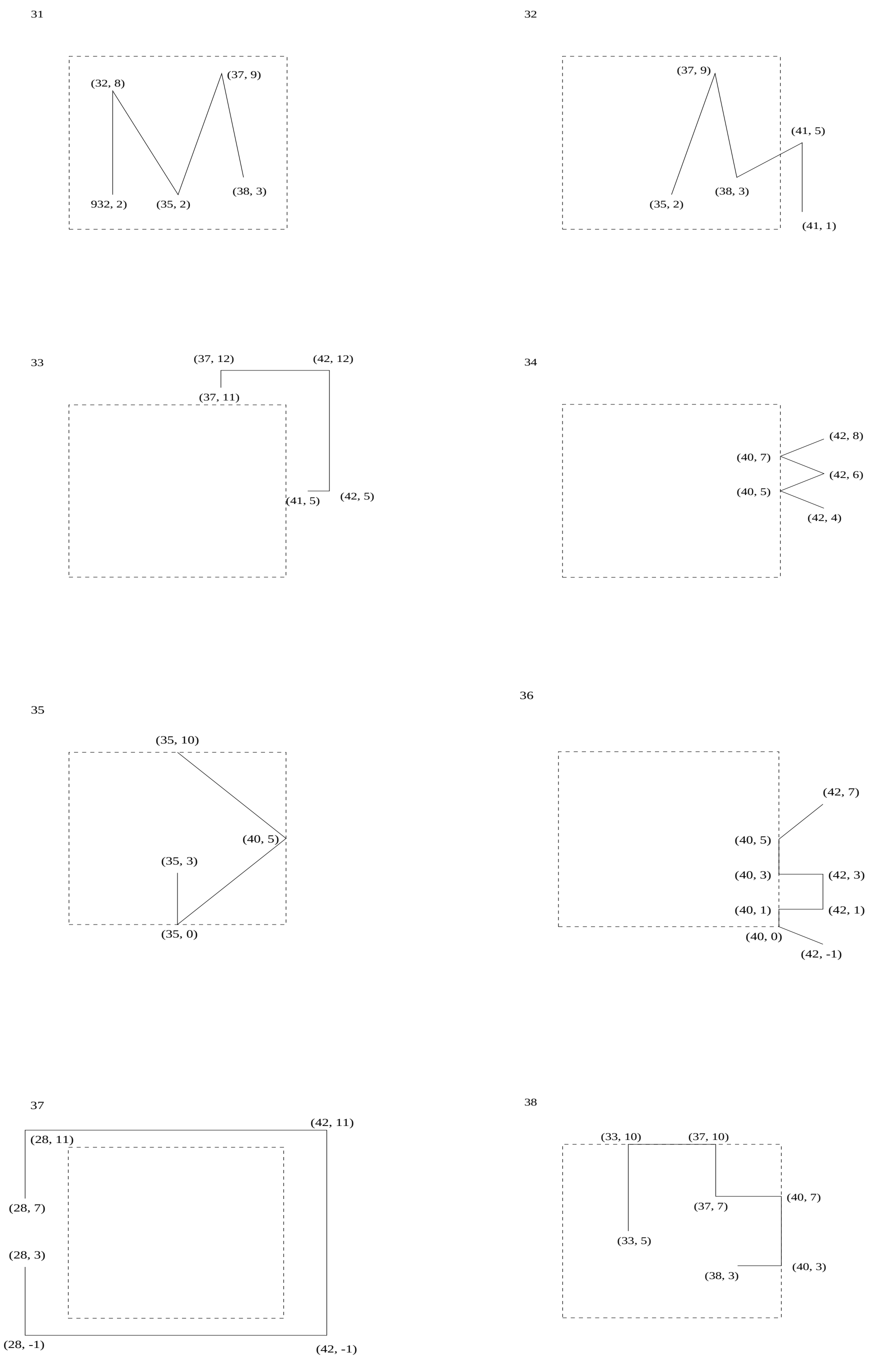


Figure 8: Polyline - Closed Polygon Tests

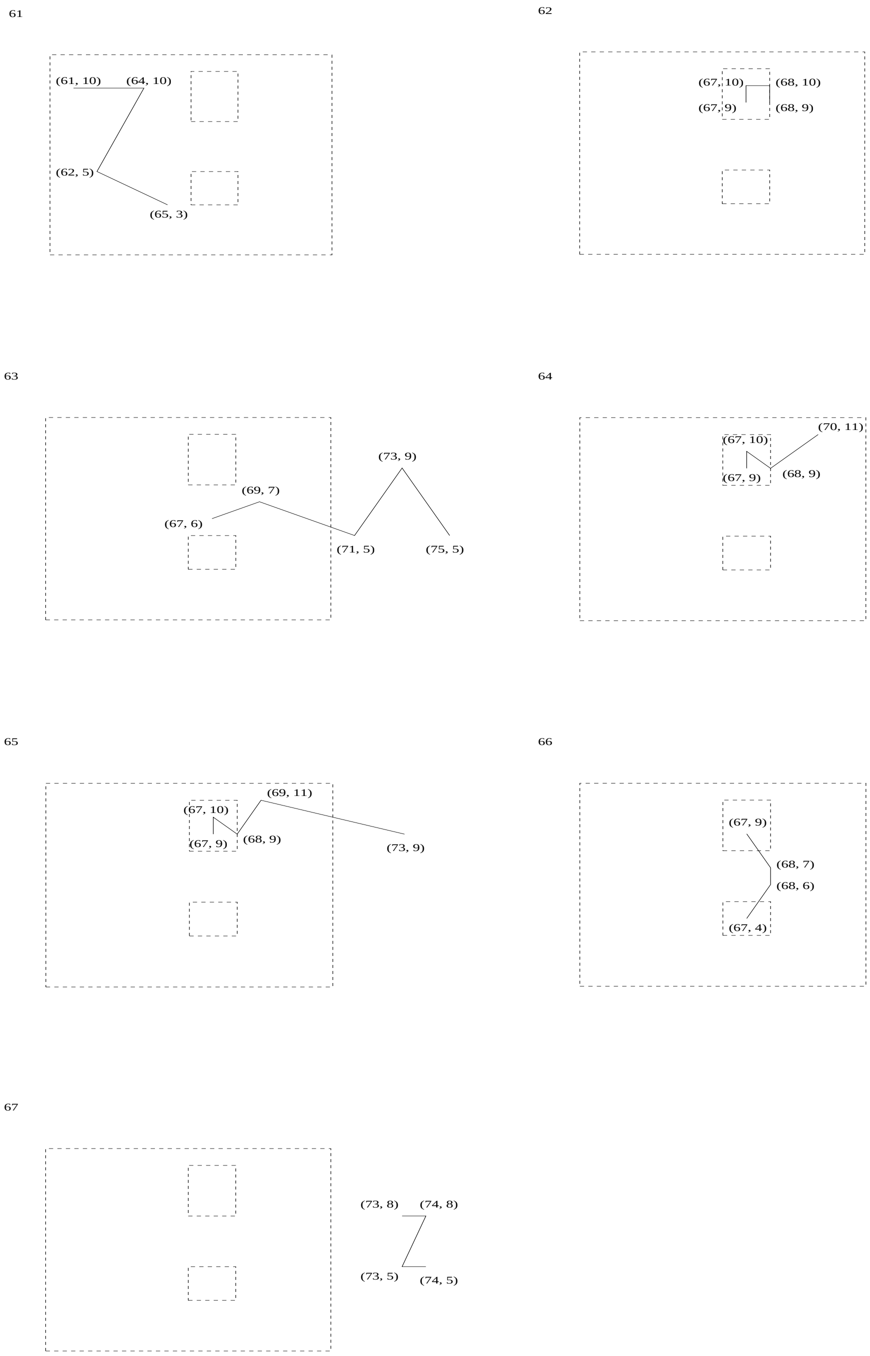


Figure 9: Polyline - Swiss Cheese Polygon Tests

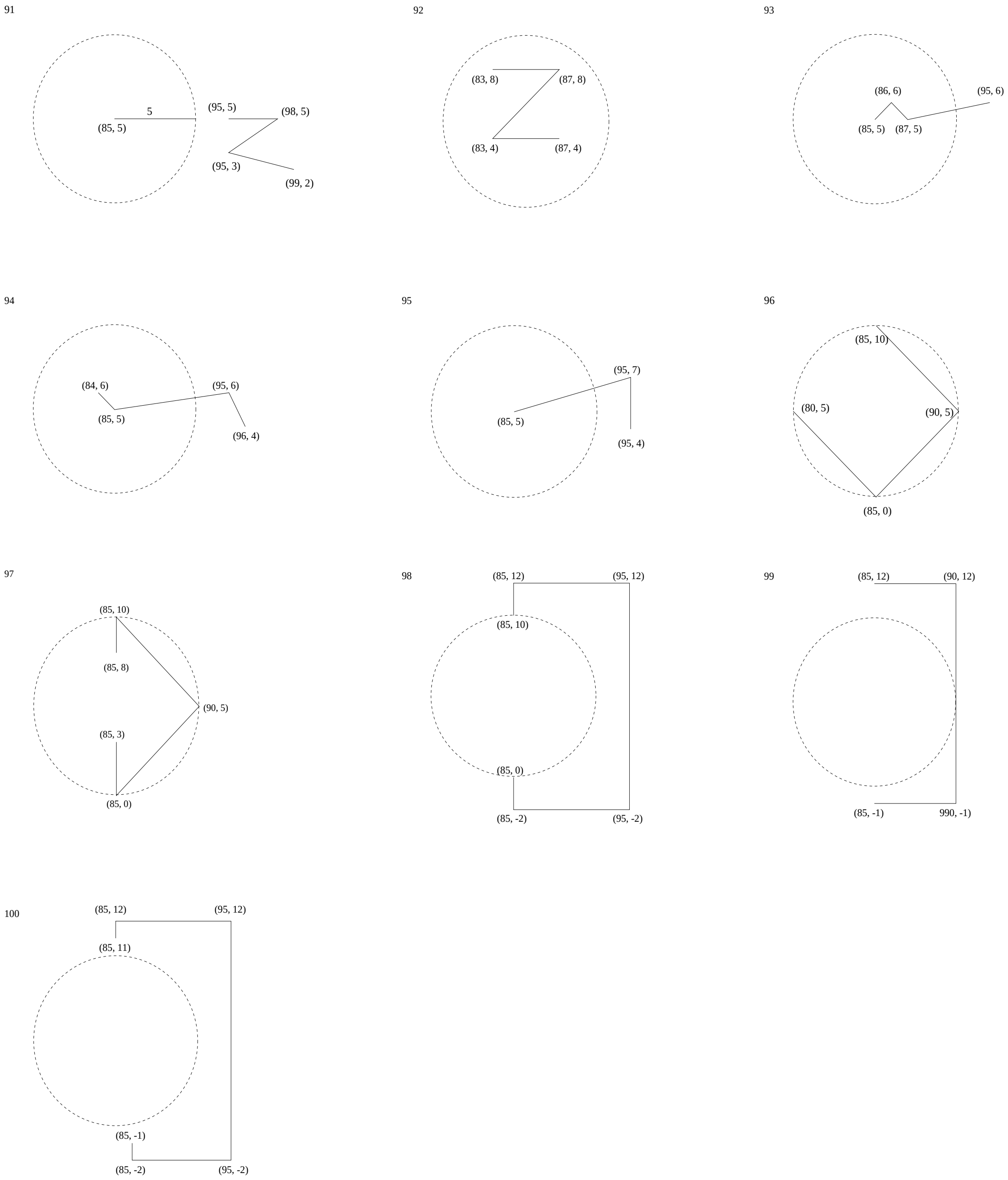


Figure 10: Polyline - Circle Tests

```
open db polyLine_test;

// test1
select id
from polyLine
where polyLine.shape overlaps PolyLine ("10 2,
                                         2 2,
                                         2 10,
                                         10, 10");

// result : 0, 2


// test2
select id
from polyLine
where polyLine.shape < ClosedPolygon ("30 0,
                                       30 10,
                                       40 10,
                                       40 0");
// result : 31, 35, 38


// test3
select id
from polyLine
where polyLine.shape overlaps ClosedPolygon ("30 0,
                                              30 10,
                                              40 10,
                                              40 0");
// result : 31, 32, 34, 35, 36, 38
```

```
// test4
select id
from polyLine
where polyLine.shape < SwCheesePoly ("60 0,
                                      60 12,
                                      72 12,
                                      72 0:
                                      66 3,
                                      66 5,
                                      69 5,
                                      69 3:
                                      66 8,
                                      66 11,
                                      69 11,
                                      69 8");

// result : 61


// test5
select id
from polyLine
where polyLine.shape overlaps SwCheesePoly ("60 0,
                                             60 12,
                                             72 12,
                                             72 0:
                                             66 3,
                                             66 5,
                                             69 5,
                                             69 3:
                                             66 8,
                                             66 11,
                                             69 11,
                                             69 8");

// result : 61, 63, 64, 65, 66
```

```
// test6
select id
from polyLine
where polyLine.shape < Circle (Point (85, 5), 5);

// result: 92, 96, 97

// test7
select id
from polyLine
where polyLine.shape overlaps Circle (Point (85, 5), 5);

// result: 92, 93, 94, 95, 96, 97, 98, 99

close db polyLine_test;
```

2.4 Closed Polygons

The "Closed Polygon" test suite has 4 sets of objects. Each set tests closed polygons against one of 3 other closed polygons and circles. The different sets can be recoganised by their ids as follows.

- *0 - 11:* Closed Polygon(a) - Closed Polygon tests
- *30 - 39:* Closed Polygon(b) - Closed Polygon tests
- *60 - 68:* Closed Polygon(c) - Closed Polygon tests
- *91 -100:* Closed Polygon - Circle tests

The following figures each show each of the closed polygons (shown in dotted lines) being tested against other objects. The object id is the number seen on the top left corner of each object. The test queries (closedPolygon.query) for the closed polygon data type are listed after the figures at the end of this section.

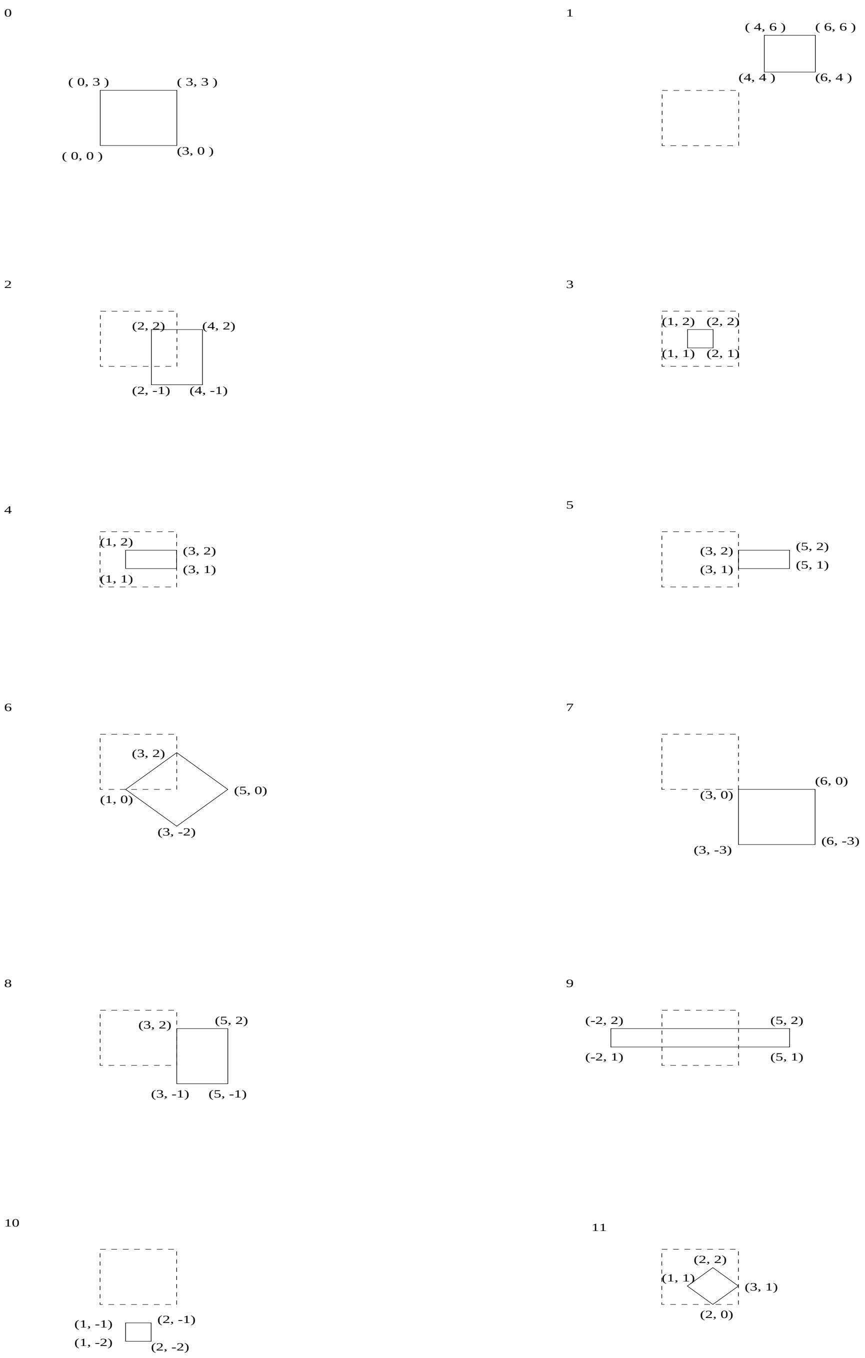


Figure 11: Closed Polygon(a) - Closed Polygon Tests

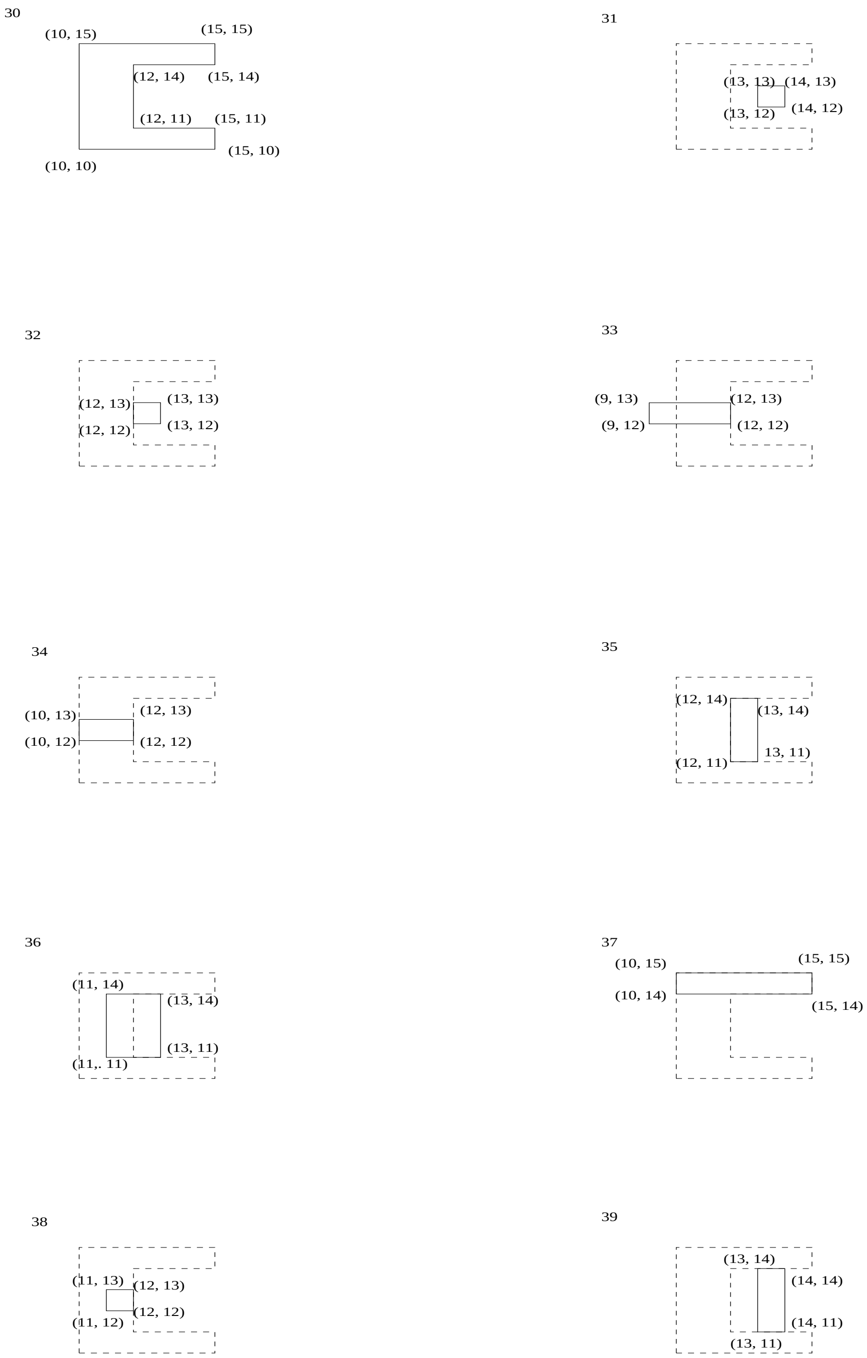


Figure 12: Closed Polygon(b) - Closed Polygon Tests

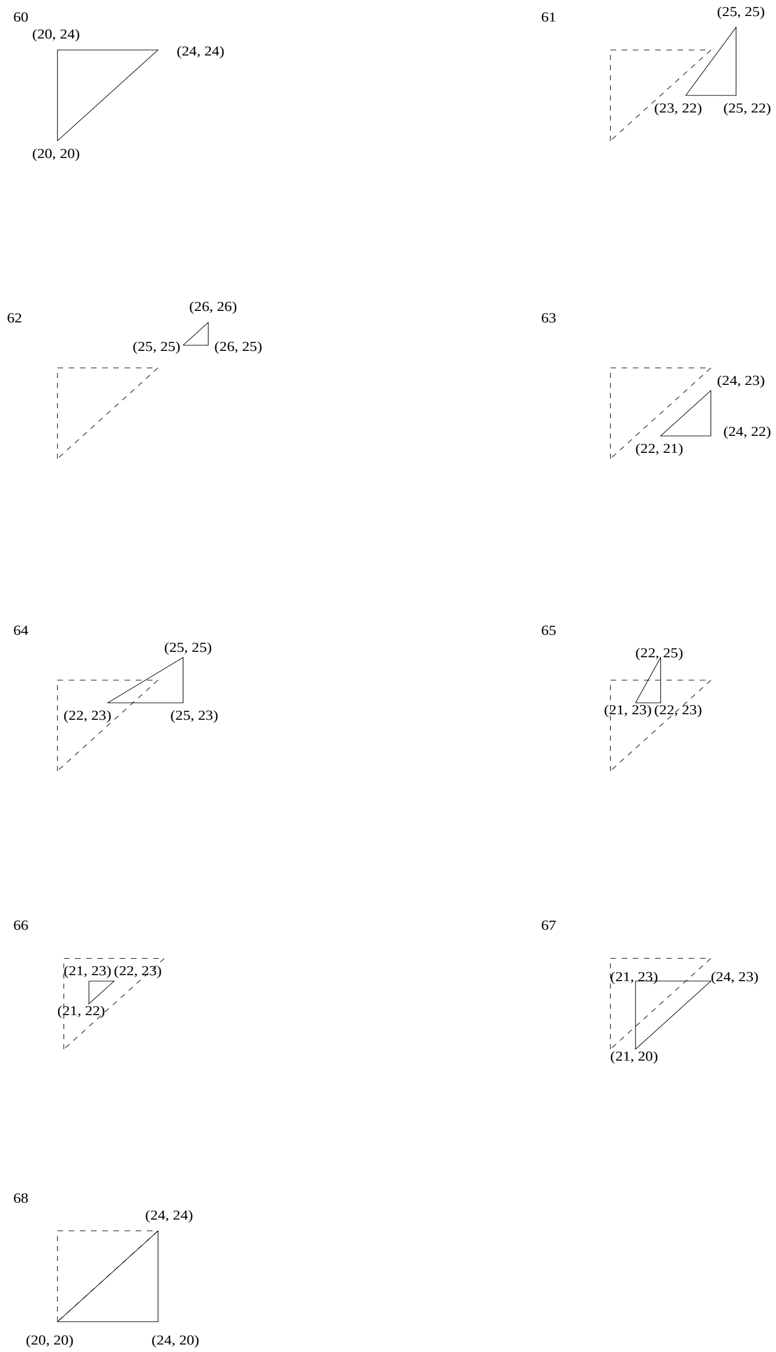


Figure 13: Closed Polygon(c) - Closed Polygon Tests

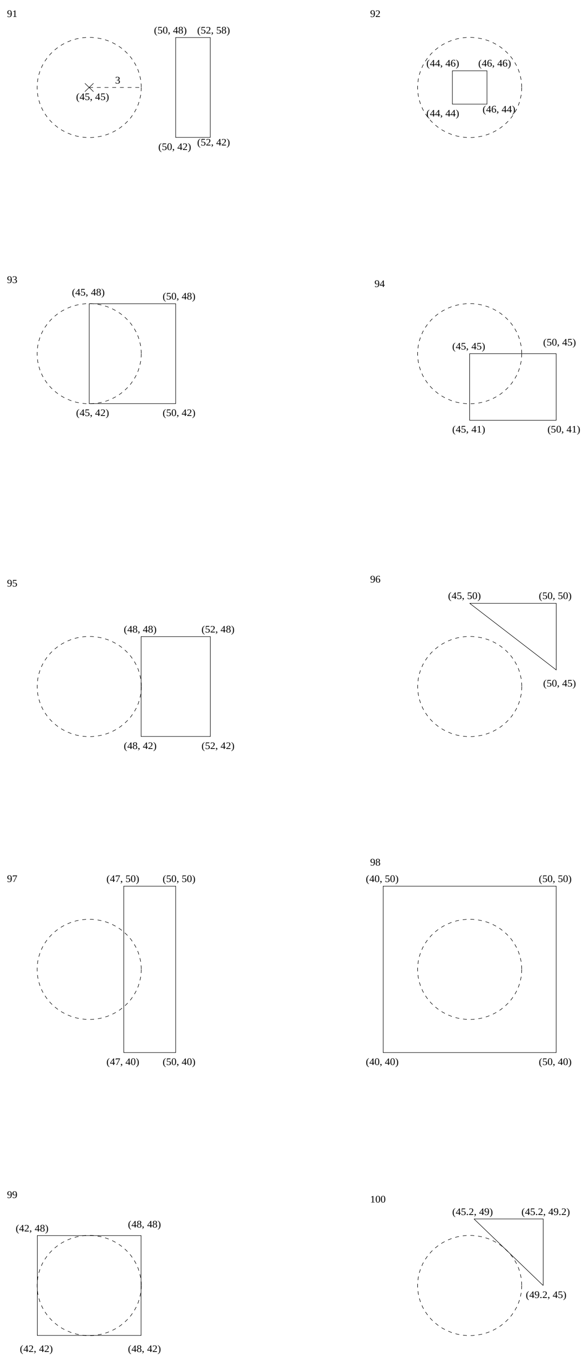


Figure 14: Closed Polygon - Circle Tests

```
open db closedPolygon_test;

// test1
select id
from closedPolygon
where closedPolygon.shape = ClosedPolygon ("0 0,
                                           0 3,
                                           3 3,
                                           3 0");
// result : 0


// test2
select id
from closedPolygon
where closedPolygon.shape < ClosedPolygon ("0 0,
                                           0 3,
                                           3 3,
                                           3 0");
// result : 3, 4, 11


// test3
select id
from closedPolygon
where closedPolygon.shape <= ClosedPolygon ("0 0,
                                            0 3,
                                            3 3,
                                            3 0");
// result : 0, 3, 4, 11


// test4
select id
from closedPolygon
where closedPolygon.shape > ClosedPolygon ("0 0,
                                           0 3,
                                           3 3,
                                           3 0");
// result : none
```

```
// test5
select id
from closedPolygon
where closedPolygon.shape >= ClosedPolygon ("0 0,
                                            0 3,
                                            3 3,
                                            3 0");
// result : 0


// test6
select id
from closedPolygon
where closedPolygon.shape overlaps ClosedPolygon ("0 0,
                                                   0 3,
                                                   3 3,
                                                   3 0");
// result : 0, 2, 3, 4, 5, 6, 7, 8, 9, 11



// test7
select id
from closedPolygon
where closedPolygon.shape = ClosedPolygon ("10 10,
                                            10 15,
                                            15 15,
                                            15 14,
                                            12 14,
                                            12 11,
                                            15 11,
                                            15 10");
// result : 30
```

```
// test8
select id
from closedPolygon
where closedPolygon.shape < ClosedPolygon ("10 10,
                                           10 15,
                                           15 15,
                                           15 14,
                                           12 14,
                                           12 11,
                                           15 11,
                                           15 10");
// result : 34, 37, 38
// current paradise result : 34, 37, 38, 35, 36, 39


// test9
select id
from closedPolygon
where closedPolygon.shape <= ClosedPolygon ("10 10,
                                           10 15,
                                           15 15,
                                           15 14,
                                           12 14,
                                           12 11,
                                           15 11,
                                           15 10");
// result : 30, 34, 37, 38
// current paradise result : 30, 34, 37, 38, 35, 36, 39


// test10
select id
from closedPolygon
where closedPolygon.shape > ClosedPolygon ("10 10,
                                           10 15,
                                           15 15,
                                           15 14,
                                           12 14,
                                           12 11,
                                           15 11,
                                           15 10");
// result : none
```

```
// test11
select id 13

from closedPolygon
where closedPolygon.shape >= ClosedPolygon ("10 10,
                                            10 15,
                                            15 15,
                                            15 14,
                                            12 14,
                                            12 11,
                                            15 11,
                                            15 10");
// result : 30


// test12
select id
from closedPolygon
where closedPolygon.shape overlaps ClosedPolygon ("10 10,
                                            10 15,
                                            15 15,
                                            15 14,
                                            12 14,
                                            12 11,
                                            15 11,
                                            15 10");
// result : 30, 32, 33, 34, 35, 36, 37, 38, 39


// test13
select id
from closedPolygon
where closedPolygon.shape = ClosedPolygon ("20 20,
                                            20 24,
                                            24 24");
// result : 60
```

```
// test14
select id
from closedPolygon
where closedPolygon.shape < ClosedPolygon ("20 20,
                                           20 24,
                                           24 24");
// result : 66


// test15
select id
from closedPolygon
where closedPolygon.shape <= ClosedPolygon ("20 20,
                                           20 24,
                                           24 24");
// result : 60, 66


// test16
select id
from closedPolygon
where closedPolygon.shape > ClosedPolygon ("20 20,
                                           20 24,
                                           24 24");
// result : none


// test17
select id
from closedPolygon
where closedPolygon.shape >= ClosedPolygon ("20 20,
                                           20 24,
                                           24 24");
// result : 60
```

```
// test18
select id
from closedPolygon
where closedPolygon.shape overlaps ClosedPolygon ("20 20,
                                                  20 24,
                                                  24 24");
// result : 60, 64, 65, 66, 67, 68


// test19
select id
from closedPolygon
where closedPolygon.shape < Circle (Point (45, 45), 3);
// result: 92

// test20
select id
from closedPolygon
where closedPolygon.shape > Circle (Point (45, 45), 3);
// result: 98

// test21
select id
from closedPolygon
where closedPolygon.shape overlaps Circle (Point (45, 45), 3);
// result: 92, 93, 94, 95, 97, 98

close db closedPolygon_test;
```

2.5 Swiss Cheese Polygons

The “Swiss Cheese Polygon” test suite has 3 sets of objects. Each set tests swiss cheese polygons against one of swiss cheese(a &b) polygons and circles. The different sets can be recoganised by their ids as follows.

- *0 - 5:* Swiss Cheese Polygon(a) - Swiss Cheese Polygon tests
- *31 - 46:* Swiss Cheese Polygon(b) - Swiss Cheese Polygon tests
- *61 - 70:* Swiss Cheese Polygon - Circles tests

The following figures each show each swiss cheese polygon (shown in dotted lines) being tested against other objects. The object id is the number seen on the top left corner of each object. The test queries (swPolygon.query) for the swiss cheese polygon data type are listed after the figures at the end of this section.

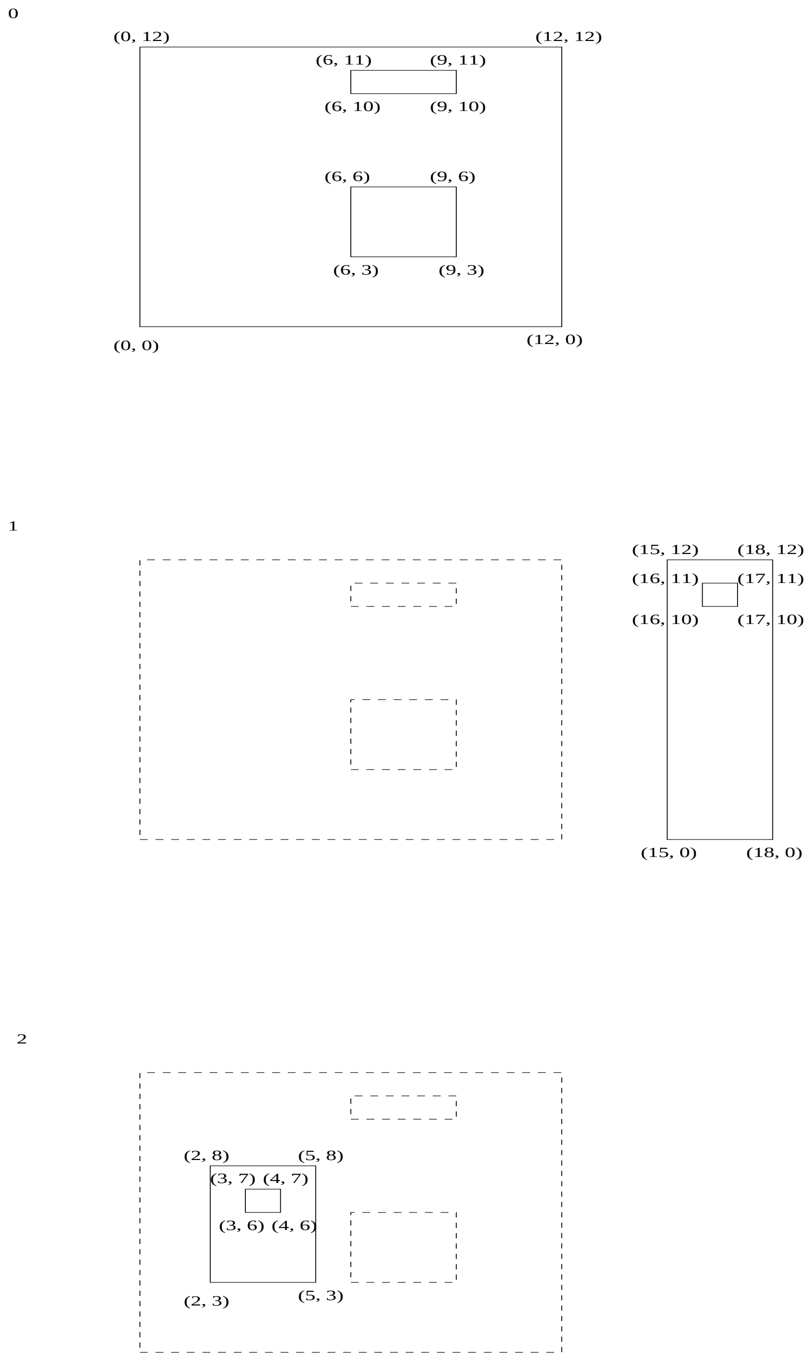
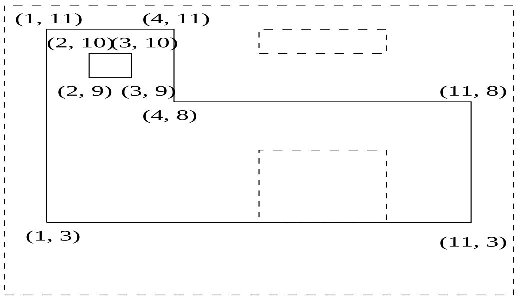
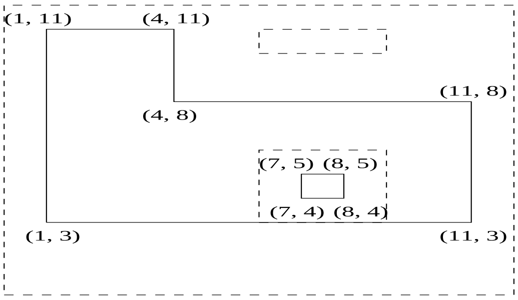


Figure 15: Swiss Cheese Polygon(a) - Swiss Cheese Polygon Tests

3



4



5

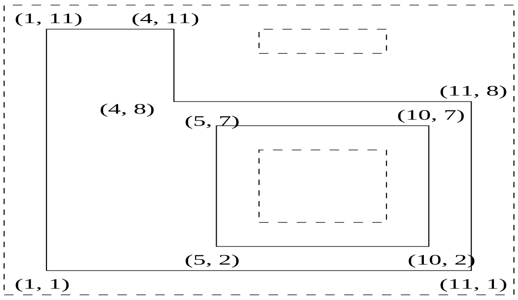
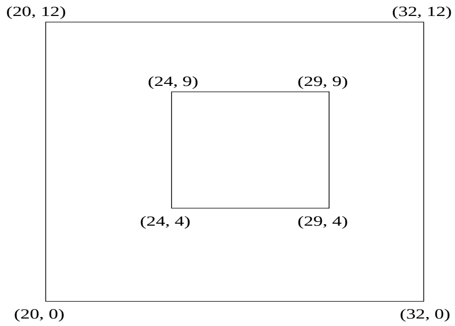
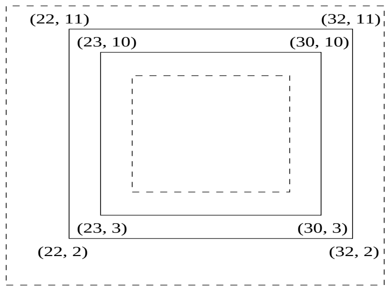


Figure 16: Swiss Cheese Polygon(a) - Swiss Cheese Polygon Tests

30



31



32

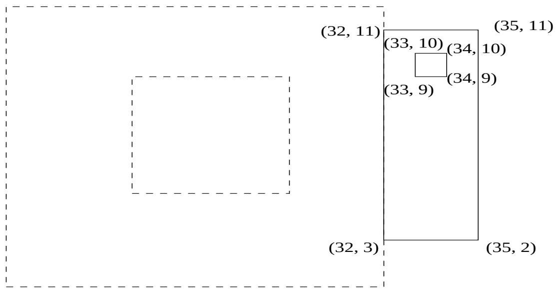
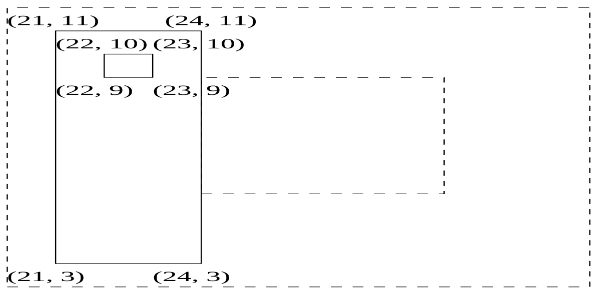
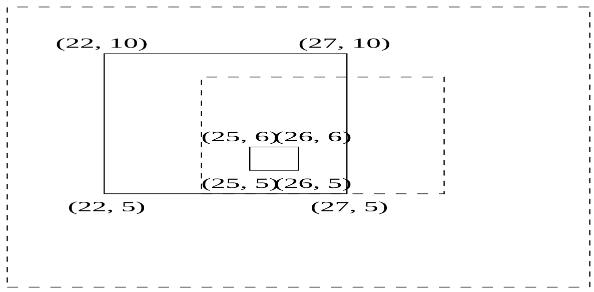


Figure 17: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

33



34



35

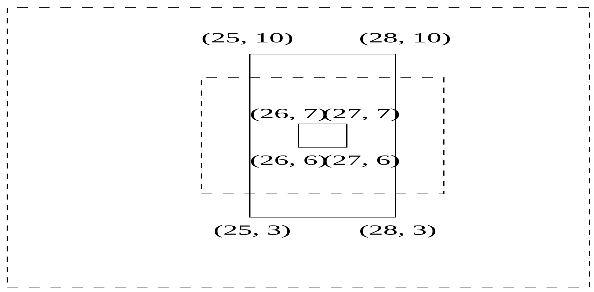
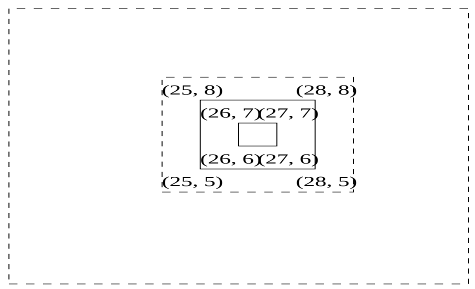
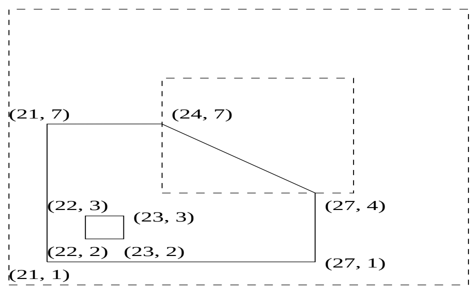


Figure 18: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

36



37



38

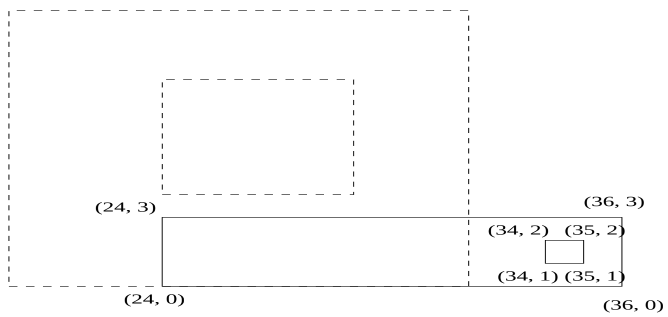
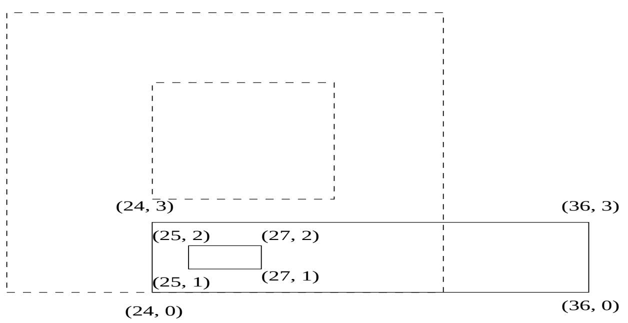
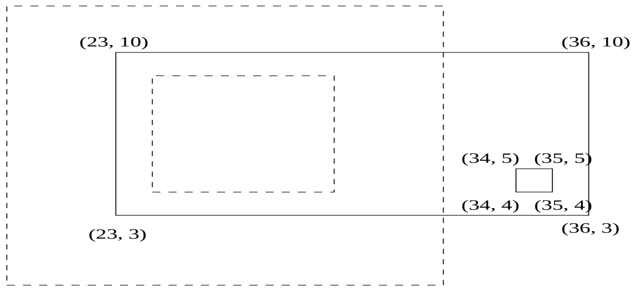


Figure 19: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

39



40



41

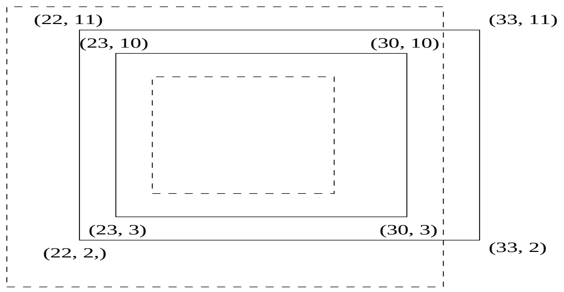
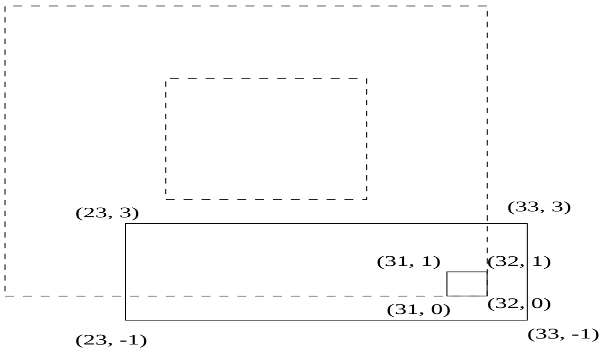
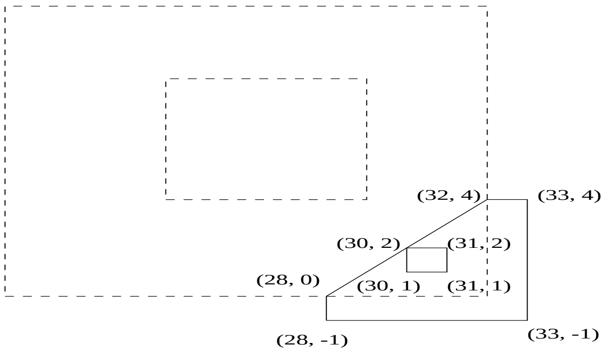


Figure 20: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

42



43



44

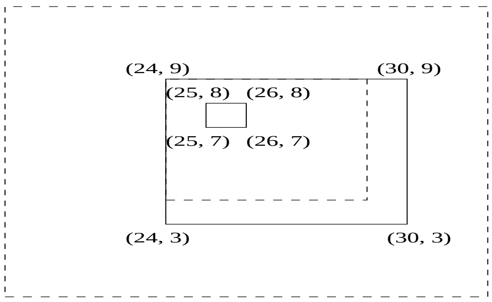
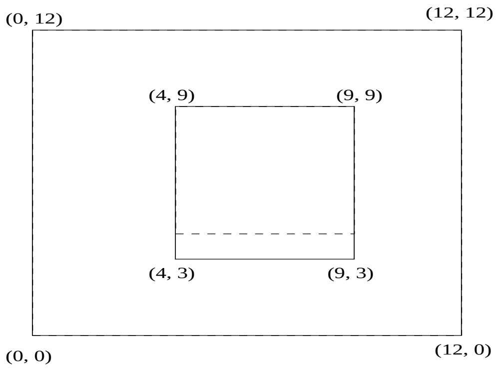


Figure 21: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

45



46

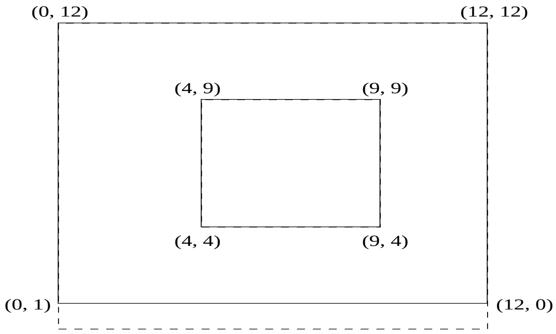


Figure 22: Swiss Cheese Polygon(b) - Swiss Cheese Polygon Tests

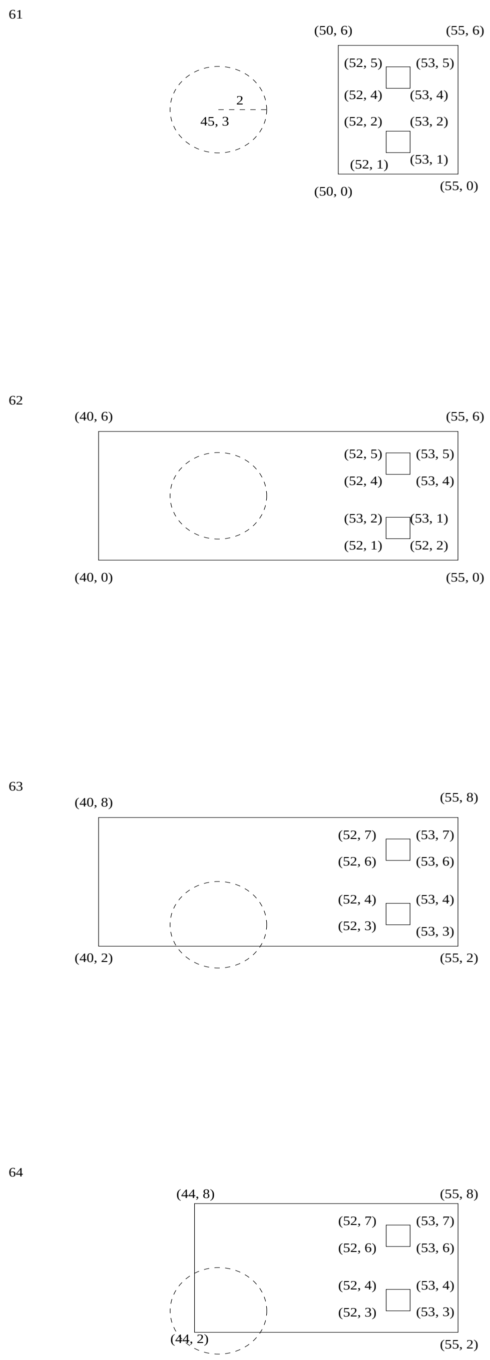


Figure 23: Swiss Cheese Polygon - Circle Tests

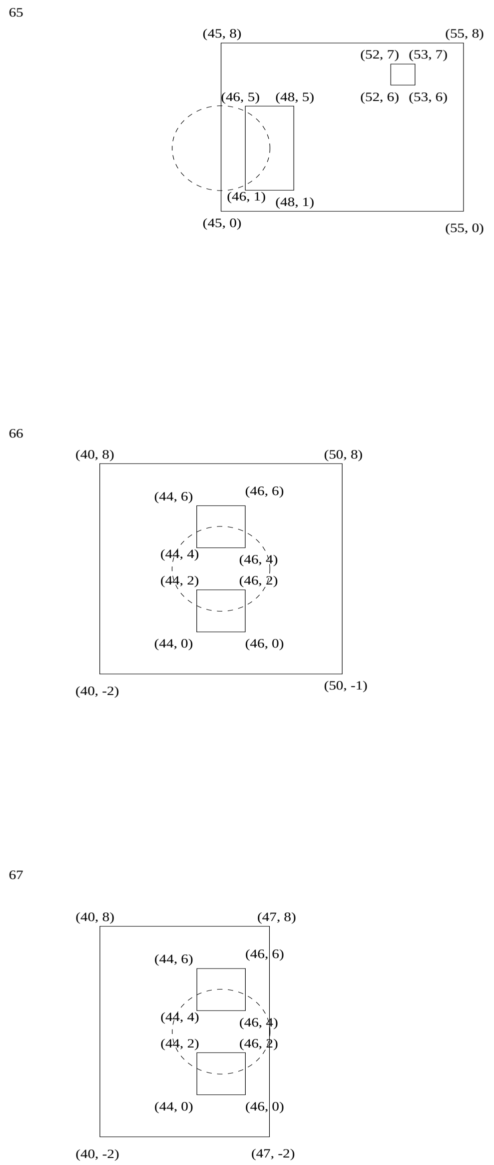


Figure 24: Swiss Cheese Polygon - Circle Tests

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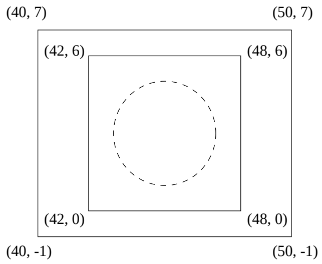
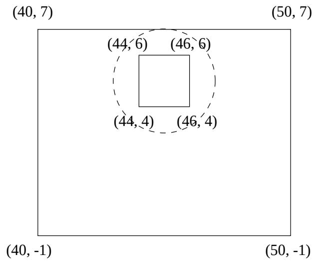


69



70

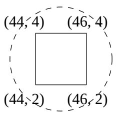


Figure 25: Swiss Cheese Polygon - Circle Tests

```
open db swPolygon_test;

// test1
select id
from swPolygon
where swPolygon.shape = SwCheesePoly ("0 0,
                                       0 12,
                                       12 12,
                                       12 0:
                                       6 3,
                                       6 6,
                                       9 6,
                                       9 3:
                                       6 10,
                                       6 11,
                                       9 11,
                                       9 10");
// result : 0


// test2
select id
from swPolygon
where swPolygon.shape < SwCheesePoly ("0 0,
                                       0 12,
                                       12 12,
                                       12 0:
                                       6 3,
                                       6 6,
                                       9 6,
                                       9 3:
                                       6 10,
                                       6 11,
                                       9 11,
                                       9 10");
// result : 2, 5
```

```
// test3
select id
from swPolygon
where swPolygon.shape <= SwCheesePoly ("0 0,
                                          0 12,
                                          12 12,
                                          12 0:
                                          6 3,
                                          6 6,
                                          9 6,
                                          9 3:
                                          6 10,
                                          6 11,
                                          9 11,
                                          9 10");
// result : 0, 2, 5


// test4
select id
from swPolygon
where swPolygon.shape > SwCheesePoly ("0 0,
                                          0 12,
                                          12 12,
                                          12 0:
                                          6 3,
                                          6 6,
                                          9 6,
                                          9 3:
                                          6 10,
                                          6 11,
                                          9 11,
                                          9 10");
// result : none
```

```
// test5
select id
from swPolygon
where swPolygon.shape >= SwCheesePoly ("0 0,
                                         0 12,
                                         12 12,
                                         12 0:
                                         6 3,
                                         6 6,
                                         9 6,
                                         9 3:
                                         6 10,
                                         6 11,
                                         9 11,
                                         9 10");
// result : 0


// test6
select id
from swPolygon
where swPolygon.shape overlaps SwCheesePoly ("0 0,
                                         0 12,
                                         12 12,
                                         12 0:
                                         6 3,
                                         6 6,
                                         9 6,
                                         9 3:
                                         6 10,
                                         6 11,
                                         9 11,
                                         9 10");

// result : 0, 2, 3, 4, 5
```

```
// test7
select id
from swPolygon
where swPolygon.shape = SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : 30

// test8
select id
from swPolygon
where swPolygon.shape < SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : 31, 33, 45, 46
// current paradise result : 31, 33, 37, 45, 46

// test9
select id
from swPolygon
where swPolygon.shape <= SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : 30, 31, 33, 45, 46
// current paradise result : 30, 31, 33, 45, 46
```

```
// test10
select id
from swPolygon
where swPolygon.shape > SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : none


// test11
select id
from swPolygon
where swPolygon.shape >= SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : 30

// test12
select id
from swPolygon
where swPolygon.shape overlaps SwCheesePoly ("20 0,
                                       20 12,
                                       32 12,
                                       32 0:
                                       24 4,
                                       24 9,
                                       29 9,
                                       29 4");

// result : 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46
```

```
// test13
select id
from swPolygon
where swPolygon.shape < Circle (Point (45, 3), 2);

// result: 70


// test14
select id
from swPolygon
where swPolygon.shape > Circle (Point (45, 3), 2);

// result: 62

// test15
select id
from swPolygon
where swPolygon.shape overlaps Circle (Point (45, 3), 2);

// result: 62, 63, 64, 65, 66, 67, 69, 70


close db swPolygon_test;
```

3 Current Paradise Problems

Currently Paradise can not distinguish between the following 3 cases for the "lessThan" operator.

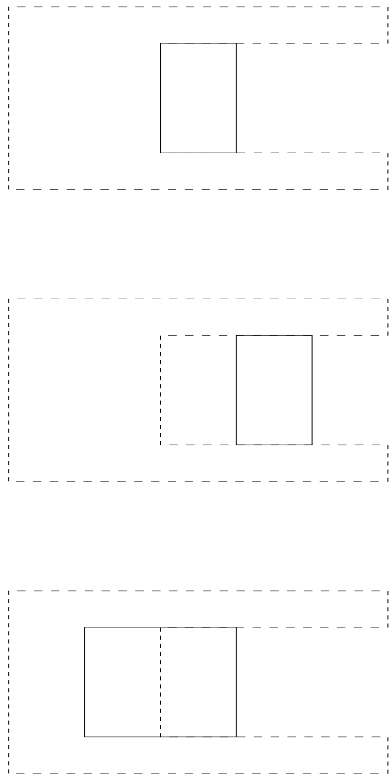


Figure 26: Problem Cases

4 Conclusion

For more information contact nirupama@cs.wisc.edu