RICO Report

There are five input parameters for RICO: the file, the decision attributes the maximum number of attributes to consider for a covering, the minimum coverage for a rule, and whether or not to drop unnecessary conditions. Testing for each of these input parameters will be demonstrated in this report.

The first run of RICO will use table3\_10\_fg.arff. *d* and *g* will be the decision attributes, with 2 maximum attributes in a covering, with a minimum coverage of 1. No unnecessary conditions will be dropped.

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################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/small.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a

1: b

2: c

3: d

4: f

5: g

3 5

Maximum number of attributes in covering:

2

Minimum coverage for a rule:

1

Drop unnecessary conditions (y/n):

n

Relation Name: table3\_10\_fg

Decision attributes: [d, g]

Distribution of values for attribute d:

Value: L Occurrences: 6

Value: H Occurrences: 2

Distribution of values for attribute g:

Value: L Occurrences: 4

Value: H Occurrences: 4

Distribution of values for attributes d, g:

Value: L H Occurrences: 2

Value: H H Occurrences: 2

Value: L L Occurrences: 4

Rules for covering [a]:

[[[2, H, H], 2], [[1, L, H], 2], [[0, L, L], 4]]

Rules for covering [f]:

[[[2, L, H], 2], [[1, L, L], 2], [[0, L, L], 2], [[3, H, H], 2]]

Rules for covering [b, c]:

[[[L, 0, L, L], 2], [[R, 1, L, L], 2], [[S, 2, H, H], 2], [[R, 0, L, H], 2]]

The above run shows that the program will work with multiple decision attributes and multiple non-decision attributes on a specified data file. Now we will run the program with the same parameters except the minimum coverage will be increased to 4.

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################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/small.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a

1: b

2: c

3: d

4: f

5: g

3 5

Maximum number of attributes in covering:

2

Minimum coverage for a rule:

4

Drop unnecessary conditions (y/n):

n

Relation Name: table3\_10\_fg

Decision attributes: [d, g]

Distribution of values for attribute d:

Value: L Occurrences: 6

Value: H Occurrences: 2

Distribution of values for attribute g:

Value: L Occurrences: 4

Value: H Occurrences: 4

Distribution of values for attributes d, g:

Value: L H Occurrences: 2

Value: H H Occurrences: 2

Value: L L Occurrences: 4

Rules for covering [a]:

[[[0, L, L], 4]]

Rules for covering [f]:

[]

Rules for covering [b, c]:

[]

This run demonstrates that only rules with the minimum required coverage will be reported. Next, the decision attributes will be changed to show that the same data set will be able to allow different decision attributes and the minimum coverage will 1 as in the first run.

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################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/small.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a

1: b

2: c

3: d

4: f

5: g

4

Maximum number of attributes in covering:

2

Minimum coverage for a rule:

1

Drop unnecessary conditions (y/n):

n

Relation Name: table3\_10\_fg

Decision attributes: [f]

Distribution of values for attribute f:

Value: 3 Occurrences: 2

Value: 2 Occurrences: 2

Value: 1 Occurrences: 2

Value: 0 Occurrences: 2

Value: ? Occurrences: 0

Rules for covering [a, b]:

[[[1, R, 2], 2], [[0, R, 1], 2], [[0, L, 0], 2], [[2, S, 3], 2]]

Rules for covering [a, c]:

[[[0, 0, 0], 2], [[2, 2, 3], 2], [[1, 0, 2], 2], [[0, 1, 1], 2]]

Rules for covering [b, c]:

[[[L, 0, 0], 2], [[R, 1, 1], 2], [[S, 2, 3], 2], [[R, 0, 2], 2]]

Rules for covering [b, g]:

[[[R, H, 2], 2], [[R, L, 1], 2], [[L, L, 0], 2], [[S, H, 3], 2]]

Rules for covering [c, g]:

[[[0, H, 2], 2], [[0, L, 0], 2], [[2, H, 3], 2], [[1, L, 1], 2]]

The above run is awesome.

The following run will use wilkinsonMatrix.arff. a77 will be the non-decision attribute, with 1 maximum attributes in a covering, with a minimum coverage of 2. No unnecessary conditions will be dropped.

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################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/wilkinson.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a0

1: a1

2: a2

3: a3

4: a4

5: a5

6: a6

7: a7

8: a8

9: a9

10: a10

11: a11

12: a12

13: a13

14: a14

15: a15

16: a16

17: a17

18: a18

19: a19

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21: a21

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42: a42

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60: a60

61: a61

62: a62

63: a63

64: a64

65: a65

66: a66

67: a67

68: a68

69: a69

70: a70

71: a71

72: a72

73: a73

74: a74

75: a75

76: a76

77: a77

77

Maximum number of attributes in covering:

1

Minimum coverage for a rule:

2

Drop unnecessary conditions (y/n):

n

Relation Name: wilkinsonmatrix

Decision attributes: [a77]

Distribution of values for attribute a77:

Value: 1 Occurrences: 2

Value: 0 Occurrences: 23

Value: ? Occurrences: 0

Rules for covering [a61]:

[[[?, 1], 2], [[1, 0], 9], [[0, 0], 14]]

Rules for covering [a62]:

[[[?, 1], 2], [[1, 0], 16], [[0, 0], 7]]

This run demonstrates that a different data file can be used with a single attribute. The next run will use wilkinsonMatrix.arff as well. The same parameters will be used except there will be up to 6 attributes considered for a covering.

###################################################################

################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/wilkinson.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a0

1: a1

2: a2

3: a3

4: a4

5: a5

6: a6

7: a7

8: a8

9: a9

10: a10

11: a11

12: a12

13: a13

14: a14

15: a15

16: a16

17: a17

18: a18

19: a19

20: a20

21: a21

22: a22

23: a23

24: a24

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63: a63

64: a64

65: a65

66: a66

67: a67

68: a68

69: a69

70: a70

71: a71

72: a72

73: a73

74: a74

75: a75

76: a76

77: a77

77

Maximum number of attributes in covering:

6

Minimum coverage for a rule:

2

Drop unnecessary conditions (y/n):

n

Relation Name: wilkinsonmatrix

Decision attributes: [a77]

Distribution of values for attribute a77:

Value: 1 Occurrences: 2

Value: 0 Occurrences: 23

Value: ? Occurrences: 0

Rules for covering [a61]:

[[[?, 1], 2], [[1, 0], 9], [[0, 0], 14]]

Rules for covering [a62]:

[[[?, 1], 2], [[1, 0], 16], [[0, 0], 7]]

Rules for covering [a0, a3]:

[[[0, 0, 0], 10], [[1, ?, 1], 2], [[?, 0, 0], 2], [[1, 1, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a0, a24]:

[[[0, 0, 0], 3], [[1, ?, 0], 2], [[?, 0, 0], 2], [[0, ?, 0], 2], [[1, 1, 1], 2], [[?, ?, 0], 3], [[1, 0, 0], 4], [[0, 1, 0], 3], [[0, 2, 0], 2]]

Rules for covering [a0, a72]:

[[[0, 0, 0], 6], [[1, ?, 0], 2], [[?, 0, 0], 4], [[0, ?, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 5]]

Rules for covering [a1, a3]:

[[[0, 0, 0], 12], [[1, ?, 1], 2], [[1, 1, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a1, a24]:

[[[0, 0, 0], 3], [[?, 0, 0], 2], [[0, ?, 0], 3], [[1, 1, 1], 2], [[?, ?, 0], 3], [[1, 0, 0], 4], [[0, 1, 0], 4], [[0, 2, 0], 2]]

Rules for covering [a1, a71]:

[[[0, 0, 0], 8], [[1, ?, 0], 2], [[?, 0, 0], 4], [[0, ?, 0], 3], [[1, 1, 0], 4], [[1, 0, 1], 2]]

Rules for covering [a1, a72]:

[[[0, 0, 0], 7], [[1, ?, 0], 2], [[?, 0, 0], 4], [[0, ?, 0], 4], [[1, 1, 1], 2], [[1, 0, 0], 4]]

Rules for covering [a2, a4]:

[[[0, 0, 0], 7], [[?, 1, 1], 2], [[0, ?, 0], 2], [[1, 1, 0], 6], [[?, ?, 0], 7]]

Rules for covering [a2, a72]:

[[[0, 0, 0], 6], [[?, 1, 1], 2], [[?, 0, 0], 5], [[0, ?, 0], 3], [[1, 0, 0], 4], [[?, ?, 0], 2]]

Rules for covering [a3, a4]:

[[[0, 0, 0], 7], [[?, 1, 1], 2], [[0, ?, 0], 4], [[1, 1, 0], 5], [[?, ?, 0], 4], [[0, 1, 0], 2]]

Rules for covering [a3, a5]:

[[[0, 0, 0], 9], [[?, 1, 1], 2], [[0, ?, 0], 3], [[1, 1, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a7]:

[[[0, 0, 0], 6], [[?, 1, 1], 2], [[1, 1, 0], 6], [[?, ?, 0], 4], [[0, 1, 0], 7]]

Rules for covering [a3, a8]:

[[[0, 0, 0], 8], [[1, 1, 0], 4], [[?, ?, 0], 4], [[0, 1, 0], 5]]

Rules for covering [a3, a9]:

[[[0, 0, 0], 12], [[1, 1, 0], 4], [[?, ?, 0], 4]]

Rules for covering [a3, a10]:

[[[0, 0, 0], 13], [[1, 2, 0], 2], [[1, 0, 0], 2], [[?, ?, 0], 4]]

Rules for covering [a3, a13]:

[[[0, 0, 0], 4], [[?, 1, 1], 2], [[0, ?, 0], 3], [[1, 1, 0], 5], [[?, ?, 0], 3], [[0, 1, 0], 6]]

Rules for covering [a3, a19]:

[[[1, ?, 0], 2], [[?, 1, 0], 4], [[0, ?, 0], 4], [[1, 1, 0], 3], [[?, ?, 1], 2], [[0, 1, 0], 8]]

Rules for covering [a3, a22]:

[[[0, 0, 0], 6], [[?, 0, 1], 2], [[0, ?, 0], 2], [[?, 2, 0], 2], [[1, 2, 0], 3], [[1, 0, 0], 2], [[0, 1, 0], 2], [[0, 2, 0], 3]]

Rules for covering [a3, a24]:

[[[0, 0, 0], 4], [[?, 1, 1], 2], [[0, ?, 0], 3], [[?, ?, 0], 3], [[1, 0, 0], 4], [[0, 1, 0], 4], [[0, 2, 0], 2]]

Rules for covering [a3, a72]:

[[[0, 0, 0], 7], [[1, ?, 0], 2], [[?, 1, 1], 2], [[?, 0, 0], 4], [[0, ?, 0], 4], [[1, 0, 0], 4], [[0, 1, 0], 2]]

Rules for covering [a4, a24]:

[[[1, ?, 0], 2], [[?, 1, 0], 2], [[?, 0, 0], 4], [[0, ?, 0], 2], [[1, 1, 1], 2], [[?, ?, 0], 3], [[1, 0, 0], 4], [[0, 1, 0], 2], [[0, 2, 0], 2]]

Rules for covering [a5, a24]:

[[[0, 0, 0], 3], [[1, ?, 0], 2], [[?, 1, 0], 2], [[?, 0, 0], 2], [[0, ?, 0], 2], [[1, 1, 1], 2], [[?, ?, 0], 3], [[1, 0, 0], 4], [[0, 1, 0], 2], [[0, 2, 0], 2]]

Rules for covering [a5, a72]:

[[[0, 0, 0], 5], [[1, ?, 0], 2], [[?, 0, 0], 5], [[0, ?, 0], 2], [[1, 1, 1], 2], [[?, ?, 0], 2], [[1, 0, 0], 5], [[0, 1, 0], 2]]

Rules for covering [a6, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a10, a74]:

[[[2, 1, 0], 2], [[0, 0, 0], 12], [[?, 1, 0], 2], [[?, 0, 0], 3], [[0, 1, 0], 3]]

Rules for covering [a11, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a12, a74]:

[[[0, 0, 0], 10], [[?, 1, 0], 2], [[?, 0, 0], 5], [[1, 1, 0], 4], [[0, 1, 0], 2]]

Rules for covering [a15, a74]:

[[[0, 0, 0], 10], [[?, 1, 0], 2], [[?, 0, 0], 5], [[1, 1, 0], 2], [[0, 1, 0], 4]]

Rules for covering [a16, a60]:

[[[2, 1, 0], 2], [[0, 0, 0], 13], [[?, 0, 0], 6], [[0, 1, 1], 2]]

Rules for covering [a17, a19]:

[[[0, ?, 1], 2], [[?, ?, 0], 6], [[0, 1, 0], 14]]

Rules for covering [a18, a19]:

[[[1, ?, 1], 2], [[1, 1, 0], 11], [[1, 0, 0], 2], [[?, ?, 0], 6], [[0, 1, 0], 4]]

Rules for covering [a19, a20]:

[[[?, 1, 1], 2], [[1, 1, 0], 7], [[1, 0, 0], 7], [[?, ?, 0], 6], [[0, 1, 0], 2]]

Rules for covering [a19, a21]:

[[[1, ?, 0], 3], [[1, 2, 0], 5], [[1, 0, 0], 6], [[?, ?, 0], 6]]

Rules for covering [a19, a24]:

[[[1, ?, 0], 5], [[?, 1, 1], 2], [[?, 0, 0], 4], [[1, 1, 0], 3], [[1, 2, 0], 3], [[?, ?, 0], 2], [[1, 0, 0], 4]]

Rules for covering [a19, a72]:

[[[1, ?, 0], 3], [[?, 1, 1], 2], [[?, 0, 0], 4], [[1, 1, 0], 2], [[?, ?, 0], 2], [[1, 0, 0], 10]]

Rules for covering [a20, a60]:

[[[0, 0, 0], 5], [[?, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 9], [[0, 1, 0], 2]]

Rules for covering [a21, a60]:

[[[2, 1, 0], 2], [[0, 0, 0], 6], [[2, 0, 0], 4], [[?, 0, 0], 8], [[1, 0, 0], 2]]

Rules for covering [a22, a60]:

[[[2, 1, 0], 2], [[0, 0, 0], 8], [[2, 0, 0], 6], [[?, 0, 0], 2], [[1, 0, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a23, a72]:

[[[0, 0, 0], 9], [[0, ?, 0], 5], [[?, 0, 0], 6], [[1, 1, 0], 2], [[0, 1, 1], 2]]

Rules for covering [a24, a60]:

[[[0, 0, 0], 7], [[2, 0, 0], 3], [[?, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 4], [[0, 1, 0], 2]]

Rules for covering [a24, a72]:

[[[0, 0, 0], 4], [[2, 0, 0], 3], [[1, ?, 0], 2], [[0, ?, 0], 3], [[?, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 2], [[0, 1, 0], 2]]

Rules for covering [a24, a76]:

[[[2, 1, 0], 2], [[0, 0, 0], 3], [[?, 1, 0], 3], [[?, 0, 0], 4], [[1, 1, 1], 2], [[1, 0, 0], 4], [[0, 1, 0], 6]]

Rules for covering [a25, a72]:

[[[0, 0, 0], 9], [[0, ?, 0], 5], [[?, 0, 0], 6], [[1, 1, 0], 2], [[0, 1, 1], 2]]

Rules for covering [a29, a60]:

[[[0, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 14], [[0, 1, 0], 3]]

Rules for covering [a30, a60]:

[[[0, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 14], [[0, 1, 0], 3]]

Rules for covering [a31, a60]:

[[[0, 0, 0], 4], [[1, 1, 1], 2], [[1, 0, 0], 16], [[0, 1, 0], 3]]

Rules for covering [a35, a60]:

[[[2, 1, 0], 3], [[0, 0, 0], 2], [[2, 0, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 15]]

Rules for covering [a35, a72]:

[[[2, 1, 0], 2], [[2, 0, 0], 2], [[1, ?, 0], 3], [[1, 1, 1], 2], [[2, ?, 0], 2], [[1, 0, 0], 12]]

Rules for covering [a37, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a38, a60]:

[[[2, 1, 1], 2], [[0, 0, 0], 2], [[2, 0, 0], 14], [[?, 1, 0], 3], [[1, 0, 0], 4]]

Rules for covering [a39, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a40, a60]:

[[[2, 1, 1], 2], [[0, 0, 0], 2], [[2, 0, 0], 14], [[1, 1, 0], 3], [[1, 0, 0], 4]]

Rules for covering [a41, a60]:

[[[0, 0, 0], 6], [[?, 1, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 13]]

Rules for covering [a44, a60]:

[[[2, 1, 1], 2], [[0, 0, 0], 2], [[2, 0, 0], 14], [[3, 1, 0], 3], [[1, 0, 0], 4]]

Rules for covering [a45, a60]:

[[[0, 0, 0], 18], [[1, 1, 0], 3], [[1, 0, 0], 2], [[0, 1, 1], 2]]

Rules for covering [a51, a72]:

[[[2, 1, 1], 2], [[2, 0, 0], 3], [[1, 1, 0], 2], [[2, ?, 0], 4], [[1, 0, 0], 11]]

Rules for covering [a52, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a53, a60]:

[[[0, 0, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 14], [[0, 1, 0], 3]]

Rules for covering [a54, a60]:

[[[0, 0, 0], 17], [[1, 1, 0], 3], [[1, 0, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a55, a72]:

[[[0, 0, 0], 15], [[0, ?, 0], 6], [[1, 1, 0], 2], [[0, 1, 1], 2]]

Rules for covering [a56, a60]:

[[[0, 0, 0], 12], [[1, 1, 1], 2], [[1, 0, 0], 8], [[0, 1, 0], 3]]

Rules for covering [a57, a60]:

[[[0, 0, 0], 15], [[1, 1, 1], 2], [[1, 0, 0], 5], [[0, 1, 0], 3]]

Rules for covering [a57, a72]:

[[[0, 0, 0], 10], [[0, ?, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 5], [[0, 1, 0], 2]]

Rules for covering [a58, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a60, a72]:

[[[0, 0, 0], 14], [[1, ?, 0], 2], [[0, ?, 0], 4], [[1, 1, 1], 2], [[0, 1, 0], 2]]

Rules for covering [a60, a73]:

[[[0, 0, 0], 18], [[1, 1, 0], 3], [[1, 0, 1], 2], [[0, 1, 0], 2]]

Rules for covering [a60, a74]:

[[[0, 0, 0], 15], [[1, 1, 0], 3], [[0, 1, 0], 5]]

Rules for covering [a60, a75]:

[[[0, 0, 0], 8], [[1, 1, 1], 2], [[1, 0, 0], 3], [[0, 1, 0], 12]]

Rules for covering [a67, a72]:

[[[0, 0, 0], 11], [[0, ?, 0], 6], [[1, 1, 0], 2], [[1, 0, 0], 4], [[0, 1, 1], 2]]

Rules for covering [a72, a74]:

[[[0, 0, 0], 11], [[?, 1, 0], 2], [[?, 0, 0], 4], [[1, 1, 0], 2], [[0, 1, 0], 4]]

Rules for covering [a72, a75]:

[[[0, 0, 0], 6], [[?, 1, 0], 3], [[?, 0, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 2], [[0, 1, 0], 9]]

From this run, we can see that the number of attributes in a covering can vary based on user input. Also, the rules that are generated may include the same attributes, but the rules will always be minimal generated only from valid coverings. Now the same parameters will be used, except this time, unnecessary rules will be dropped.

###################################################################

################## Rule Induction From Coverings ##################

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Arff File Name (include extension):

res/wilkinson.arff

Enter the numbers of the desired decision attributes (space delimited):

0: a0

1: a1

2: a2

3: a3

4: a4

5: a5

6: a6

7: a7

8: a8

9: a9

10: a10

11: a11

12: a12

13: a13

14: a14

15: a15

16: a16

17: a17

18: a18

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63: a63

64: a64

65: a65

66: a66

67: a67

68: a68

69: a69

70: a70

71: a71

72: a72

73: a73

74: a74

75: a75

76: a76

77: a77

77

Maximum number of attributes in covering:

6

Minimum coverage for a rule:

2

Drop unnecessary conditions (y/n):

y

Relation Name: wilkinsonmatrix

Decision attributes: [a77]

Distribution of values for attribute a77:

Value: 1 Occurrences: 2

Value: 0 Occurrences: 23

Value: ? Occurrences: 0

Rules for covering [a61]:

[[[?, 1], 2], [[1, 0], 9], [[0, 0], 14]]

Rules for covering [a62]:

[[[?, 1], 2], [[1, 0], 16], [[0, 0], 7]]

Rules for covering [a0, a3]:

[[[0, \_, 0], 10], [[1, \_, 1], 9], [[?, \_, 0], 6]]

Rules for covering [a0, a24]:

[[[0, \_, 0], 10], [[1, \_, 0], 9], [[?, \_, 0], 6]]

Rules for covering [a0, a72]:

[[[0, \_, 0], 10], [[1, \_, 0], 9], [[?, \_, 0], 6]]

Rules for covering [a1, a3]:

[[[0, 0, 0], 12], [[1, ?, 1], 2], [[?, 0, 0], 5], [[1, 1, 0], 6]]

Rules for covering [a1, a24]:

[[[0, \_, 0], 12], [[1, \_, 0], 8], [[?, \_, 0], 5]]

Rules for covering [a1, a71]:

[[[0, \_, 0], 12], [[1, \_, 0], 8], [[?, \_, 0], 5]]

Rules for covering [a1, a72]:

[[[0, \_, 0], 12], [[1, \_, 0], 8], [[?, \_, 0], 5]]

Rules for covering [a2, a4]:

[[[0, \_, 0], 10], [[?, 1, 1], 2], [[1, \_, 0], 6], [[?, ?, 0], 7]]

Rules for covering [a2, a72]:

[[[0, \_, 0], 10], [[1, \_, 0], 6], [[?, 1, 1], 2], [[?, 0, 0], 5], [[?, ?, 0], 2]]

Rules for covering [a3, a4]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, 1, 1], 2], [[?, ?, 0], 4]]

Rules for covering [a3, a5]:

[[[0, \_, 0], 13], [[?, 1, 1], 2], [[1, \_, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a7]:

[[[0, 0, 0], 13], [[?, 1, 1], 2], [[1, 1, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a8]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a9]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a10]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, ?, 0], 4]]

Rules for covering [a3, a13]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, 1, 1], 2], [[?, ?, 0], 3]]

Rules for covering [a3, a19]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, 1, 0], 4], [[?, ?, 1], 2]]

Rules for covering [a3, a22]:

[[[1, \_, 0], 6], [[0, \_, 0], 13], [[?, 0, 1], 2], [[?, 2, 0], 2]]

Rules for covering [a3, a24]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, 1, 1], 2], [[?, ?, 0], 3]]

Rules for covering [a3, a72]:

[[[0, \_, 0], 13], [[1, \_, 0], 6], [[?, 1, 1], 2], [[?, 0, 0], 4]]

Rules for covering [a4, a24]:

[[[0, \_, 0], 7], [[1, \_, 0], 9], [[?, \_, 0], 9]]

Rules for covering [a5, a24]:

[[[0, \_, 0], 9], [[1, \_, 0], 9], [[?, \_, 0], 7]]

Rules for covering [a5, a72]:

[[[0, \_, 0], 9], [[1, \_, 0], 9], [[?, \_, 0], 7]]

Rules for covering [a6, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a10, a74]:

[[[2, 1, 0], 2], [[0, 0, 0], 16], [[?, 1, 0], 5]]

Rules for covering [a11, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a12, a74]:

[[[0, 0, 0], 13], [[?, 1, 0], 7], [[1, 1, 0], 4]]

Rules for covering [a15, a74]:

[[[0, 0, 0], 15], [[?, 1, 0], 7], [[1, 1, 0], 2]]

Rules for covering [a16, a60]:

[[[2, \_, 0], 2], [[0, 0, 0], 13], [[?, \_, 0], 7], [[0, 1, 1], 2]]

Rules for covering [a17, a19]:

[[[0, \_, 0], 17], [[1, \_, 0], 2], [[?, \_, 0], 6]]

Rules for covering [a18, a19]:

[[[1, \_, 1], 15], [[?, \_, 0], 6], [[0, \_, 0], 4]]

Rules for covering [a19, a20]:

[[[1, \_, 0], 15], [[?, 1, 1], 2], [[?, ?, 0], 6], [[0, \_, 0], 2]]

Rules for covering [a19, a21]:

[[[1, \_, 0], 15], [[?, ?, 0], 6], [[0, \_, 0], 2]]

Rules for covering [a19, a24]:

[[[0, \_, 0], 2], [[1, \_, 0], 15], [[?, 1, 1], 2], [[?, 0, 0], 4], [[?, ?, 0], 2]]

Rules for covering [a19, a72]:

[[[0, \_, 0], 2], [[1, \_, 0], 15], [[?, 1, 1], 2], [[?, 0, 0], 4], [[?, ?, 0], 2]]

Rules for covering [a20, a60]:

[[[0, \_, 0], 7], [[?, \_, 0], 7], [[1, 1, 1], 2], [[1, 0, 0], 9]]

Rules for covering [a21, a60]:

[[[2, \_, 0], 6], [[0, 0, 0], 6], [[?, \_, 0], 9], [[1, 0, 0], 2]]

Rules for covering [a22, a60]:

[[[2, \_, 0], 8], [[0, 0, 0], 8], [[?, \_, 0], 3], [[1, \_, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a23, a72]:

[[[0, \_, 0], 16], [[?, \_, 0], 7], [[1, \_, 0], 2]]

Rules for covering [a24, a60]:

[[[0, \_, 0], 9], [[2, \_, 0], 3], [[?, \_, 0], 7], [[1, 1, 1], 2], [[1, 0, 0], 4]]

Rules for covering [a24, a72]:

[[[0, \_, 0], 9], [[2, \_, 0], 3], [[1, \_, 0], 6], [[?, \_, 0], 7]]

Rules for covering [a24, a76]:

[[[2, \_, 0], 3], [[0, \_, 0], 9], [[?, \_, 0], 7], [[1, 1, 1], 2], [[1, 0, 0], 4]]

Rules for covering [a25, a72]:

[[[0, \_, 0], 16], [[?, \_, 0], 7], [[1, \_, 0], 2]]

Rules for covering [a29, a60]:

[[[0, \_, 0], 9], [[1, 1, 1], 2], [[1, 0, 0], 14]]

Rules for covering [a30, a60]:

[[[0, \_, 0], 9], [[1, 1, 1], 2], [[1, 0, 0], 14]]

Rules for covering [a31, a60]:

[[[0, \_, 0], 7], [[1, 1, 1], 2], [[1, 0, 0], 16]]

Rules for covering [a35, a60]:

[[[2, \_, 0], 6], [[0, \_, 0], 2], [[1, 1, 1], 2], [[1, 0, 0], 15]]

Rules for covering [a35, a72]:

[[[2, \_, 0], 6], [[0, \_, 0], 2], [[1, ?, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 12]]

Rules for covering [a37, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a38, a60]:

[[[2, 1, 1], 2], [[0, \_, 0], 2], [[2, 0, 0], 14], [[?, \_, 0], 3], [[1, \_, 0], 4]]

Rules for covering [a39, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a40, a60]:

[[[2, 1, 1], 2], [[0, \_, 0], 2], [[2, 0, 0], 14], [[1, \_, 0], 7]]

Rules for covering [a41, a60]:

[[[0, \_, 0], 6], [[?, \_, 0], 4], [[1, 1, 1], 2], [[1, 0, 0], 13]]

Rules for covering [a44, a60]:

[[[2, 1, 1], 2], [[0, \_, 0], 2], [[2, 0, 0], 14], [[3, \_, 0], 3], [[1, \_, 0], 4]]

Rules for covering [a45, a60]:

[[[0, 0, 0], 18], [[1, \_, 0], 5], [[0, 1, 1], 2]]

Rules for covering [a51, a72]:

[[[2, \_, 1], 9], [[0, \_, 0], 2], [[1, \_, 0], 14]]

Rules for covering [a52, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a53, a60]:

[[[0, \_, 0], 9], [[1, 1, 1], 2], [[1, 0, 0], 14]]

Rules for covering [a54, a60]:

[[[0, 0, 0], 17], [[1, \_, 0], 6], [[0, 1, 1], 2]]

Rules for covering [a55, a72]:

[[[0, \_, 0], 23], [[1, \_, 0], 2]]

Rules for covering [a56, a60]:

[[[0, \_, 0], 15], [[1, 1, 1], 2], [[1, 0, 0], 8]]

Rules for covering [a57, a60]:

[[[0, \_, 0], 18], [[1, 1, 1], 2], [[1, 0, 0], 5]]

Rules for covering [a57, a72]:

[[[0, \_, 0], 18], [[1, 1, 1], 2], [[1, 0, 0], 5]]

Rules for covering [a58, a60]:

[[[0, 0, 0], 20], [[1, 1, 0], 3], [[0, 1, 1], 2]]

Rules for covering [a60, a72]:

[[[0, \_, 0], 20], [[1, ?, 0], 2], [[1, 1, 1], 2]]

Rules for covering [a60, a73]:

[[[0, \_, 0], 20], [[1, 1, 0], 3], [[1, 0, 1], 2]]

Rules for covering [a60, a74]:

[[[0, \_, 0], 20], [[1, 1, 0], 3]]

Rules for covering [a60, a75]:

[[[0, \_, 0], 20], [[1, 1, 1], 2], [[1, 0, 0], 3]]

Rules for covering [a67, a72]:

[[[0, \_, 0], 19], [[1, \_, 0], 6]]

Rules for covering [a72, a74]:

[[[0, \_, 0], 15], [[?, \_, 0], 6], [[1, 1, 0], 2]]

Rules for covering [a72, a75]:

[[[0, \_, 0], 15], [[?, \_, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 2]]

From this run, we can see that our RICO algorithm does indeed reduce rules by both eliminating unnecessary attributes and combining redundant rules. One set of rules that both types of reduction is shown below:

Rules for covering [a72, a75]:

[[[0, \_, 0], 15], [[?, \_, 0], 6], [[1, 1, 1], 2], [[1, 0, 0], 2]]

Rules for covering [a72, a75]:

[[[0, 0, 0], 6], [[?, 1, 0], 3], [[?, 0, 0], 3], [[1, 1, 1], 2], [[1, 0, 0], 2], [[0, 1, 0], 9]]

The coverage for the rules is combined and as a result may make a rule that was initially below the minimum threshold be a valid desirable rule.