

Program2 Report

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Question1: Harmonia in Lisp

```
(defvar *harmonia* '((1 ((grandparent x y)) ((parent x z) (parent z y)))
  (2 ((parent x y)) ((mother x y)))
  (3 ((parent x y)) ((father x y)))
  (4 ((father (Zeus) (Ares))) ())
  (5 ((mother (Hera) (Ares))) ())
  (6 ((father (Ares) (Harmonia))) ())
  (7 () ((grandparent x (Harmonia))))))
```

FOR Question Answering, Harmonia in Lisp

```
(defvar *harmonia* '((1 ((grandparent x y)) ((parent x z) (parent z y)))
  (2 ((parent x y)) ((mother x y)))
  (3 ((parent x y)) ((father x y)))
  (4 ((father (Zeus) (Ares))) ())
  (5 ((mother (Hera) (Ares))) ())
  (6 ((father (Ares) (Harmonia))) ())
  (7 ((answer x)) ((grandparent x (Harmonia))))))
```

Question2: Number of steps taken for resolution using two pointer and unit preference

rr=>Roadrunner and Coyote
howling => howling hounds
custom=> Custom Official
harmonia=> Harmonia
test => own example (shown in question 4 beginning)

Theorem	Two Pointer	Unit Preference
rr	452	150
howling	67	28
custom	46	43
harmonia	32	13
test	42	22

Question3. Comparison with Two pointer and Unit preference

In case Two Pointer method used for resolution, we maintain two pointers: inner pointer and outer pointer. The initial position of the outer pointer is set to the goal, the inner pointer starts from the 0 and tries to reach the outer pointer. Meanwhile new clauses are added in the list as we find new clauses while unifying and resolving. When inner pointer equals the outer pointer, we reset the inner pointer and increment the outer pointer by 1. This keeps on going till we get the empty clause and then the theorem is proved.

In Unit preference, we first sort the clause list and the two clauses which have minimum number of literals are chosen for the resolution. Basically we can maintain a min heap that keeps the clauses with minimum literal at the

top. Whenever we find a new clause, we can push it back into the min heap. This will also keep on going till we find empty clause and then the theorem is proved.

Overall, we can see from the table the unit preference takes the less number of steps in comparison with two pointer method because we take the clauses that have minimum literals and then resolve it. This is faster in reaching towards the result. One con with the unit preference is every time we need to sort the list whenever we add a new clause thus sorting can take a lot of time if the list is very long.

Question4.

Below are the steps for resolution using two pointer and unit preference. Also, steps for question answering for Harmonia. **The answer is Hera.**

The Following is the test theorem used that needs to be written by myself:

```
[1,[[['P','x'],['BETA']],['Q','x'],['S','y','res']],[]],
[2,[[['R','x'],['T','x']],[['P','x','w']],
[3,[[['R','x']],['Q','x']],
[4,[[['S','y'],['ZETA']],[['R','x']],
[5,[],[['S','y'],['ZETA']]],
[6,[],[['T','x']]]
]
```

TWO POINTER RESOLUTION STEPS FOR HOWLING HOUND

```
[1, [['howl', 'z']], [['hound', 'z']]]
[2, [], [['have', 'x', 'y'], ['cat', 'y'], ['have', 'x', 'z'], ['mouse', 'z']]]
[3, [], [['ls', 'w'], ['have', 'w', 'v'], ['howl', 'v']]]
[4, [['have', ['john'], ['a']]], []]
[5, [['cat', ['a']], ['hound', ['a']]], []]
[6, [['mouse', ['b']]], []]
[7, [['ls', ['john']]], []]
[8, [['have', ['john'], ['b']]], []]
[9, [], [['have', ['john'], 'v'], ['howl', 'v']]] using {'w': ['john']} 7,3
[10, [], [['cat', ['b']], ['have', ['john'], 'z'], ['mouse', 'z']]] using {'y': ['b'], 'x': ['john']} 8,2
[11, [], [['cat', 'y'], ['have', ['john'], 'y'], ['mouse', ['b']]] using {'x': ['john'], 'z': ['b']} 8,2
[12, [], [['howl', ['b']], ['ls', ['john']]] using {'w': ['john'], 'v': ['b']} 8,3
[13, [], [['have', ['john'], 'v'], ['hound', 'v']]] using {'z': 'v'} 1,9
[14, [], [['howl', ['a']]] using {'v': ['a']} 4,9
[15, [], [['howl', ['b']]] using {'v': ['b']} 8,9
[16, [], [['cat', ['b']], ['mouse', ['a']]] using {'z': ['a']} 4,10
[17, [['hound', ['a']], [['have', ['john'], 'z'], ['mouse', 'z']]] using {'b': 'a'} 5,10
[18, [], [['cat', ['b']], ['have', ['john'], ['b']]] using {'z': ['b']} 6,10
[19, [], [['cat', ['b']], ['mouse', ['b']]] using {'z': ['b']} 8,10
[20, [], [['cat', ['a']], ['mouse', ['b']]] using {'y': ['a']} 4,11
[21, [['hound', ['a']], [['have', ['john'], ['a']], ['mouse', ['b']]] using {'y': ['a']} 5,11
[22, [], [['cat', 'y'], ['have', ['john'], 'y']]] using {} 6,11
[23, [], [['hound', ['b']], ['ls', ['john']]] using {'z': ['b']} 1,12
[24, [], [['hound', ['a']]] using {'v': ['a']} 4,13
[25, [['cat', ['a']], [['have', ['john'], ['a']]] using {'v': ['a']} 5,13
[26, [], [['hound', ['b']]] using {'v': ['b']} 8,13
[27, [['hound', ['a']], [['mouse', ['a']]] using {'b': 'a'} 5,16
[28, [], [['cat', ['b']]] using {'a': 'b'} 6,16
[29, [['howl', ['a']], [['have', ['john'], 'z3852'], ['mouse', 'z3852']]] using {'z': ['a']} 17,1
[30, [['hound', ['a']], [['have', ['john'], ['b']]] using {'z': ['b']} 6,17
[31, [['hound', ['a']], [['mouse', ['b']]] using {'z': ['b']} 8,17
[32, [], [['have', ['john'], ['a']], ['have', ['john'], 'z'], ['mouse', 'z']]] using {'v': ['a']} 17,13
[33, [['hound', ['a']], [['have', ['john'], ['a']]] using {'b': 'a'} 5,18
[34, [], [['cat', ['a']]] using {} 6,20
[35, [['howl', ['a']], [['have', ['john'], ['a']], ['mouse', ['b']]] using {'z': ['a']} 21,1
[36, [], [['have', ['john'], ['a']], ['mouse', ['b']]] using {'v': ['a']} 21,13
[37, [['cat', ['a']], [['ls', ['john']]] using {'b': 'a'} 5,23
[38, [], [['have', ['john'], 'z'], ['ls', ['john']], ['mouse', 'z']]] using {'b': 'a'} 17,23
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[39, [], [['have', ['john'], ['a']], ['ls', ['john']], ['mouse', ['a']]]] using {'b': 'a'} 21,23
[40, [['cat', ['a']]], []] using {} 5,24
[41, [], [['have', ['john'], ['z'], ['mouse', ['z']]]] using {} 17,24
[42, [], [['have', ['john'], ['a']], ['have', 'x', ['a']], ['have', 'x', ['z'], ['mouse', ['z']]]] using {'y': ['a']} 25,2
[43, [], [['have', ['john'], ['a']], ['mouse', ['a']]]] using {'b': 'a'} 25,16
[44, [], [['have', ['john'], ['a']]]] using {'b': 'a'} 25,18
[45, [['howl', ['a']]], [['mouse', ['a']]] using {'z': ['a']} 27,1
[46, [['hound', ['b']]], []] using {'a': 'b'} 6,27
[47, [], [['ls', ['john']], ['mouse', ['a']]]] using {'b': 'a'} 27,23
[48, [], [['mouse', ['a']]]] using {} 27,24
[49, [['hound', ['a']]], []] using {'b': 'a'} 5,28
[50, [], [['have', ['john'], ['z3852'], ['have', 'w', ['a']], ['ls', 'w'], ['mouse', ['z3852']]]] using {'v': ['a']} 29,3
[51, [['howl', ['a']]], [['have', ['john'], ['b']]]] using {'z3852': ['b']} 6,29
[52, [['howl', ['a']]], [['mouse', ['b']]]] using {'z3852': ['b']} 8,29
[53, [], [['have', ['john'], ['a']], ['have', ['john'], ['z3852'], ['mouse', ['z3852']]]] using {'v': ['a']} 29,9
[54, [], [['have', ['john'], ['z3852'], ['ls', ['john']], ['mouse', ['z3852']]]] using {'b': 'a'} 29,12
[55, [], [['have', ['john'], ['z3852'], ['mouse', ['z3852']]]] using {} 29,14
[56, [], [['have', ['john'], ['a']], ['have', ['john'], ['b']]]] using {'v': ['a']} 30,13
[57, [], [['have', ['john'], ['a']], ['ls', ['john']]]] using {'b': 'a'} 30,23
[58, [], [['have', ['john'], ['b']]]] using {} 30,24
[59, [], [['mouse', ['b']]]] using {} 31,24
[60, [['howl', ['a']]], [['have', ['john'], ['a']]]] using {'z': ['a']} 33,1
[61, [], [['have', ['john'], ['a']], ['have', 'w', ['a']], ['ls', 'w'], ['mouse', ['b']]]] using {'v': ['a']} 35,3
[62, [], [['have', 'x', ['a']], ['have', 'x', ['z'], ['ls', ['john']], ['mouse', ['z']]]] using {'y': ['a']} 37,2
[63, [], [['have', ['john'], ['a']], ['ls', ['john']], ['mouse', ['b']]]] using {'y': ['a']} 37,11
[64, [], [['ls', ['john']], ['mouse', ['b']]]] using {} 37,20
[65, [], [['ls', ['john']]]] using {'b': 'a'} 37,28
[66, [], [['have', ['john'], ['b']], ['ls', ['john']]]] using {'z': ['b']} 6,38
[67, [], [['have', 'x', ['a']], ['have', 'x', ['z'], ['mouse', ['z']]]] using {'y': ['a']} 40,2
FINAL RES: 40,28('NUMBER OF STEPS:', 67)

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TWO POINTER RESOLUTION STEPS FOR Custom

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[1, [['v', 'x'], ['s', 'x', ['f', 'x']]], [['e', 'x']]]
[2, [['v', 'y'], ['c', ['f', 'y']]], [['e', 'y']]]
[3, [['e', ['a']]], []]
[4, [['d', ['a']]], []]
[5, [['d', ['z']]], [['s', ['a'], ['z']]]]
[6, [], [['d', 'w'], ['v', 'w']]]
[7, [], [['d', 'r'], ['c', 'r']]]
[8, [['v', 'y']], [['d', ['f', 'y']], ['e', 'y']]] using {'r': ['f', 'y']} 2,7
[9, [], [['c', ['a']]]] using {'r': ['a']} 4,7
[10, [], [['c', 'r'], ['s', ['a'], ['r']]]] using {'z': 'r'} 5,7
[11, [['v', ['a']]], [['d', ['f', ['a']]]]] using {'y': ['a']} 3,8
[12, [['v', 'y']], [['e', 'y'], ['s', ['a'], ['f', 'y']]]] using {'z': ['f', 'y']} 5,8
[13, [], [['d', ['f', 'w']], ['d', 'w'], ['e', 'w']]] using {'y': 'w'} 8,6
[14, [['v', ['a']]], [['c', ['f', ['a']]], ['e', ['a']]]] using {'x': ['a'], 'r': ['f', ['a']]} 1,10
[15, [['v', ['a']]], [['s', ['a'], ['f', ['a']]]]] using {'z': ['f', ['a']]} 5,11
[16, [], [['d', ['a']], ['d', ['f', ['a']]]]] using {'w': ['a']} 11,6
[17, [['v', ['a']]], [['e', ['a']]]] using {'y': ['a'], 'x': ['a']} 1,12
[18, [], [['d', 'w'], ['e', 'w'], ['s', ['a'], ['f', 'w']]]] using {'y': 'w'} 12,6
[19, [], [['d', ['f', ['a']]], ['e', ['a']]]] using {'w': ['a']} 4,13
[20, [], [['d', ['f', 'w']], ['e', 'w'], ['s', ['a'], 'w']]] using {'z': 'w'} 5,13
[21, [['v', ['a']]], [['c', ['f', ['a']]]]] using {} 3,14
[22, [], [['c', ['f', ['a']]], ['d', ['a']], ['e', ['a']]]] using {'w': ['a']} 14,6
[23, [], [['d', ['a']], ['s', ['a'], ['f', ['a']]]]] using {'w': ['a']} 15,6
[24, [], [['d', ['f', ['a']]]]] using {} 4,16
[25, [], [['d', ['f', ['a']]], ['s', ['a'], ['a']]]] using {'z': ['a']} 5,16
[26, [['v', ['a']]], []] using {} 3,17
[27, [], [['d', ['a']], ['e', ['a']]]] using {'w': ['a']} 17,6
[28, [['v', ['a']]], [['d', ['a']], ['e', ['a']]]] using {'x': ['a'], 'w': ['a']} 1,18
[29, [], [['e', ['a']], ['s', ['a'], ['f', ['a']]]]] using {'w': ['a']} 4,18
[30, [], [['e', 'w'], ['s', ['a'], ['f', 'w']], ['s', ['a'], 'w']]] using {'z': 'w'} 5,18
[31, [['v', ['a']]], [['d', ['f', ['a']]], ['e', ['a']], ['e', ['f', ['a']]]]] using {'x': ['a'], 'w': ['f', ['a']]} 1,20

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[32, [], [['c', 'f', ['a']], ['d', ['a']]] using {'w': ['a']} 21,6
[33, [], [['c', 'f', ['a']], ['e', ['a']]] using {} 4,22
[34, [], [['c', 'f', ['a']], ['e', ['a']], ['s', ['a'], ['a']]] using {'z': ['a']} 5,22
[35, [], [['s', ['a'], ['f', ['a']]]]] using {} 4,23
[36, [], [['s', ['a'], ['a']], ['s', ['a'], ['f', ['a']]]]] using {'z': ['a']} 5,23
[37, [], [['d', ['a']]] using {'w': ['a']} 26,6
[38, [], [['e', ['a']]] using {} 4,27
[39, [], [['e', ['a']], ['s', ['a'], ['a']]] using {'z': ['a']} 5,27
[40, [['v', ['a']]], [['d', ['a']]] using {} 3,28
[41, [['v', ['a']]], [['e', ['a']], ['s', ['a'], ['a']]] using {'z': ['a']} 5,28
[42, [['v', ['a']]], [['e', ['a']], ['e', ['f', ['a']]], ['s', ['a'], ['f', ['f', ['a']]]]] using {'x': ['a'], 'w': ['f', ['a']]} 1,30
[43, [['v', ['a']]], [['d', ['f', ['f', ['a']]], ['e', ['f', ['a']]]]] using {} 3,31
[44, [], [['d', ['a']], ['d', ['f', ['f', ['a']]], ['e', ['a']], ['e', ['f', ['a']]]]] using {'w': ['a']} 31,6
[45, [], [['c', ['f', ['a']]]]] using {} 4,32
[46, [], [['c', ['f', ['a']]], ['s', ['a'], ['a']]] using {'z': ['a']} 5,32
FINAL RES: 4,37('NUMBER OF STEPS:', 46)

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TWO POINTER RESOLUTION STEPS FOR Roadrunner

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[1, [['rr', ['a']]], [['coyote', 'y']]]
[2, [['chase', 'z', ['a']]], [['coyote', 'z']]]
[3, [['smart', 'x']], [['rr', 'x'], ['beep', 'x']]]
[4, [], [['coyote', 'w'], ['rr', 'u'], ['catch', 'w', 'u'], ['smart', 'u']]]
[5, [['frustrated', 's'], ['catch', 's', 't']], [['coyote', 's'], ['rr', 't'], ['chase', 's', 't']]]
[6, [['beep', 'r']], [['rr', 'r']]]
[7, [['coyote', ['b']]], []]
[8, [], [['frustrated', ['b']]]]
[9, [['rr', ['a']]], []] using {'y': ['b']} 7,1
[10, [['chase', ['b'], ['a']]], []] using {'z': ['b']} 7,2
[11, [], [['catch', ['b'], 'u'], ['rr', 'u'], ['smart', 'u']]] using {'w': ['b']} 7,4
[12, [['catch', ['b'], 't'], ['frustrated', ['b']]], [['chase', ['b'], 't'], ['rr', 't']]] using {'s': ['b']} 7,5
[13, [['catch', ['b'], 't']], [['chase', ['b'], 't'], ['coyote', ['b']], ['rr', 't']]] using {'s': ['b']} 5,8
[14, [['smart', ['a']]], [['beep', ['a']]] using {'x': ['a']} 9,3
[15, [], [['catch', 'w', ['a']], ['coyote', 'w'], ['smart', ['a']]] using {'u': ['a']} 9,4
[16, [['catch', 's', ['a']], ['frustrated', 's']], [['chase', 's', ['a']], ['coyote', 's']]] using {'t': ['a']} 9,5
[17, [['beep', ['a']]], []] using {'r': ['a']} 9,6
[18, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['coyote', ['b']], ['rr', ['a']]] using {'s': ['b'], 't': ['a']} 10,5
[19, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['smart', ['a']]] using {'u': ['a']} 1,11
[20, [], [['beep', 'u'], ['catch', ['b'], 'u'], ['rr', 'u']]] using {'x': 'u'} 3,11
[21, [['frustrated', ['b']]], [['chase', ['b'], 't'], ['coyote', ['b']], ['rr', 't'], ['smart', 't']]] using {'s': ['b'], 'u': 't'} 5,11
[22, [], [['catch', ['b'], ['a']], ['smart', ['a']]] using {'u': ['a']} 9,11
[23, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['chase', ['b'], ['a']], ['coyote', 'y']]] using {'t': ['a']} 1,12
[24, [['catch', ['b'], 't']], [['chase', ['b'], 't'], ['rr', 't']]] using {} 12,8
[25, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['chase', ['b'], ['a']]] using {'t': ['a']} 9,12
[26, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['rr', ['a']]] using {'t': ['a']} 10,12
[27, [['frustrated', ['b']]], [['chase', ['b'], 't'], ['rr', 't'], ['smart', 't']]] using {'u': 't'} 12,11
[28, [['catch', ['b'], ['a']], [['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y']]] using {'t': ['a']} 1,13
[29, [['catch', ['b'], ['a']]], [['coyote', ['b']], ['rr', ['a']]] using {'z': ['b'], 't': ['a']} 2,13
[30, [], [['chase', ['b'], 't'], ['coyote', ['b']], ['rr', 't'], ['smart', 't']]] using {'u': 't', 'w': ['b']} 13,4
[31, [['catch', ['b'], ['a']]], [['chase', ['b'], ['a']], ['coyote', ['b']]] using {'t': ['a']} 9,13
[32, [], [['beep', ['a']], ['catch', 'w', ['a']], ['coyote', 'w'], ['rr', ['a']]] using {'u': ['a']} 14,4
[33, [['smart', ['a']]], [['rr', ['a']]] using {'r': ['a']} 6,14
[34, [], [['beep', ['a']], ['catch', ['b'], ['a']], ['rr', ['a']]] using {'u': ['a']} 14,11
[35, [['frustrated', 'w']], [['chase', 'w', ['a']], ['coyote', 'w'], ['rr', ['a']], ['smart', ['a']]] using {'s': 'w', 't': ['a']} 5,15
[36, [['frustrated', ['b']]], [['chase', ['b'], ['a']], ['coyote', ['b']], ['rr', ['a']], ['smart', ['a']]] using {'t': ['a'], 'w': ['b']} 12,15
[37, [], [['chase', ['b'], ['a']], ['coyote', ['b']], ['rr', ['a']], ['smart', ['a']]] using {'t': ['a'], 'w': ['b']} 13,15
[38, [], [['beep', ['a']], ['catch', 'w', ['a']], ['coyote', 'w']]] using {} 14,15
[39, [['catch', 's', ['a']], ['frustrated', 's']], [['coyote', 's']]] using {'z': 's'} 2,16
[40, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['coyote', ['b']]] using {'s': ['b']} 10,16
[41, [['frustrated', 'w']], [['chase', 'w', ['a']], ['coyote', 'w'], ['smart', ['a']]] using {'s': 'w'} 16,15
[42, [['smart', ['a']]], []] using {} 17,14
[43, [['catch', ['b'], ['a']], ['frustrated', ['b']]], [['coyote', ['b']], ['coyote', 'y']]] using {} 1,18
[44, [['frustrated', ['b']]], [['coyote', ['b']], ['rr', ['a']], ['smart', ['a']]] using {'u': ['a'], 'w': ['b']} 18,4

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[45, [], [['beep', 'a']], ['catch', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']]] using {'x': 'a']} 3,19
 [46, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {'s': 'b'}, 't': 'a'}} 5,19
 [47, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {'t': 'a']} 12,19
 [48, [], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {'t': 'a']} 13,19
 [49, [], [['beep', 'a']], ['catch', 'b'], ['a']], ['coyote', 'y']] using {} 14,19
 [50, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['smart', 'a']]] using {'s': 'b']} 16,19
 [51, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {} 18,19
 [52, [['frustrated', 'b']], [['beep', 't'], ['chase', 'b'], 't'], ['coyote', 'b']], ['rr', 't']]] using {'s': 'b'}, 'u': 't'} 5,20
 [53, [], [['catch', 'b'], 'u'], ['rr', 'u']]] using {'r': 'u'} 6,20
 [54, [], [['beep', 'a']], ['catch', 'b'], ['a']]] using {'u': 'a'} 9,20
 [55, [['frustrated', 'b']], [['beep', 't'], ['chase', 'b'], 't'], ['rr', 't']]] using {'u': 't'} 12,20
 [56, [], [['beep', 't'], ['chase', 'b'], 't'], ['coyote', 'b']], ['rr', 't']]] using {'u': 't'} 13,20
 [57, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']], ['rr', 'a']]] using {'s': 'b'}, 'u': 'a'} 16,20
 [58, [], [['catch', 'b'], 'a'], ['rr', 'a']]] using {'u': 'a'} 17,20
 [59, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['rr', 'a']]] using {'u': 'a'} 18,20
 [60, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['smart', 'a']]] using {'t': 'a'} 9,21
 [61, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['rr', 'a']], ['smart', 'a']]] using {'t': 'a'} 12,22
 [62, [['catch', 'b'], 'a'], ['chase', 'b'], ['a']], ['coyote', 'y']] using {} 23,8
 [63, [['catch', 'b'], 'a'], ['frustrated', 'b']], ['coyote', 'y']] using {} 10,23
 [64, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']]] using {} 23,19
 [65, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']]] using {'u': 'a'} 23,20
 [66, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['smart', 'a']]] using {} 23,22
 [67, [['catch', 'b'], 'a'], ['chase', 'b'], ['a']]] using {'t': 'a'} 9,24
 [68, [['catch', 'b'], 'a'], ['rr', 'a']]] using {'t': 'a'} 10,24
 [69, [], [['chase', 'b'], 't'], ['rr', 't'], ['smart', 't']]] using {'u': 't'} 24,11
 [70, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {'t': 'a'} 24,19
 [71, [], [['beep', 't'], ['chase', 'b'], 't'], ['rr', 't']]] using {'u': 't'} 24,20
 [72, [], [['chase', 'b'], 'a'], ['rr', 'a']], ['smart', 'a']]] using {'t': 'a'} 24,22
 [73, [['catch', 'b'], 'a'], ['frustrated', 'b']], []] using {} 10,25
 [74, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['rr', 'a']]] using {'u': 'a'} 25,20
 [75, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['smart', 'a']]] using {} 25,22
 [76, [['frustrated', 'b']], ['rr', 'a']], ['smart', 'a']]] using {'u': 'a'} 26,11
 [77, [['frustrated', 'b']], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {} 26,19
 [78, [['frustrated', 'b']], [['beep', 'a']], ['rr', 'a']]] using {'u': 'a'} 26,20
 [79, [['catch', 'b'], 'a'], ['coyote', 'b']], ['coyote', 'y']] using {'z': 'b'} 2,28
 [80, [], [['chase', 'b'], 'a'], ['coyote', 'b']], ['coyote', 'y'], ['smart', 'a']]] using {'w': 'b'} 28,15
 [81, [], [['chase', 'b'], 'a'], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y3715'], ['smart', 'a']]] using {} 28,19
 [82, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']]] using {'u': 'a'} 28,20
 [83, [], ['coyote', 'b']], ['rr', 'a']], ['smart', 'a']]] using {'u': 'a'}, 'w': 'b'} 29,4
 [84, [['catch', 'b'], 'a'], ['coyote', 'b']]] using {} 9,29
 [85, [], ['coyote', 'b'], ['coyote', 'y'], ['rr', 'a']], ['smart', 'a']]] using {} 29,19
 [86, [], [['beep', 'a']], ['coyote', 'b']], ['rr', 'a']]] using {'u': 'a'} 29,20
 [87, [], [['chase', 'b'], 'a'], ['coyote', 'b']], ['smart', 'a']]] using {'t': 'a'} 9,30
 [88, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']], ['rr', 'a']]] using {'t': 'a'} 14,30
 [89, [], [['beep', 'a']], ['catch', 'w'], ['a']], ['coyote', 'w'], ['coyote', 'y']] using {} 1,32
 [90, [['frustrated', 'w']], [['beep', 'a']], ['chase', 'w'], ['a']], ['coyote', 'w'], ['rr', 'a']]] using {'s': 'w'}, 't': 'a'} 5,32
 [91, [], [['catch', 'w'], 'a'], ['coyote', 'w'], ['rr', 'a']]] using {'r': 'a'} 6,32
 [92, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['rr', 'a']]] using {'w': 'b'} 23,32
 [93, [['smart', 'a']], ['coyote', 'y']] using {} 1,33
 [94, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['rr', 'a']]] using {} 33,19
 [95, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['rr', 'a']]] using {'t': 'a'} 33,21
 [96, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['rr', 'a']]] using {'t': 'a'} 33,27
 [97, [], [['chase', 'b'], 'a'], ['coyote', 'b']], ['rr', 'a']]] using {'t': 'a'} 33,30
 [98, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['rr', 'a']]] using {'t': 'a'} 24,34
 [99, [['frustrated', 'w']], ['chase', 'w'], ['a']], ['coyote', 'w'], ['coyote', 'y'], ['smart', 'a']]] using {} 1,35
 [100, [['frustrated', 'w']], ['coyote', 'w'], ['rr', 'a']], ['smart', 'a']]] using {'z': 'w'} 2,35
 [101, [['frustrated', 'w']], ['chase', 'w'], ['a']], ['coyote', 'w'], ['rr', 'a']]] using {} 33,35
 [102, [['frustrated', 'w']], [['beep', 'a']], ['chase', 'w'], ['a']], ['coyote', 'w']]] using {'s': 'w'} 16,38
 [103, [], [['catch', 'w'], 'a'], ['coyote', 'w']]] using {} 17,38
 [104, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y']] using {'w': 'b'} 23,38
 [105, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']]] using {'w': 'b'} 25,38
 [106, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y']]] using {'w': 'b'} 28,38
 [107, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']]] using {'w': 'b'} 31,38
 [108, [['frustrated', 'w']], ['coyote', 'w'], ['smart', 'a']]] using {'s': 'w'} 39,15
 [109, [['frustrated', 'b']], ['coyote', 'b'], ['coyote', 'y'], ['smart', 'a']]] using {'s': 'b'} 39,19

[110, [['frustrated', 'b']], [['coyote', 'b']], ['smart', 'a']] using {'s': 'b'} 39,22
 [111, [['frustrated', 'w']], [['beep', 'a']], ['coyote', 'w'], ['rr', 'a']] using {'s': 'w'} 39,32
 [112, [['frustrated', 'w']], [['beep', 'a']], ['coyote', 'w']] using {'s': 'w'} 39,38
 [113, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']] using {'w': 'b'} 40,38
 [114, [], [['catch', 'b'], ['a']], ['coyote', 'y']] using {} 42,19
 [115, [], [['catch', 'b'], ['a']]] using {} 42,22
 [116, [['frustrated', 'w']], [['chase', 'w', 'a']], ['coyote', 'w']] using {} 42,41
 [117, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5907'], ['smart', 'a']] using {} 43,19
 [118, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {'u': 'a'} 43,20
 [119, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y']] using {'w': 'b'} 43,38
 [120, [['frustrated', 'b']], [['coyote', 'b']], ['rr', 'a']] using {} 33,44
 [121, [], [['beep', 'a']], ['catch', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6970']] using {} 1,45
 [122, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y9593'], ['rr', 'a']] using {} 23,45
 [123, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']] using {'t': 'a'} 24,45
 [124, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['rr', 'a']] using {} 26,45
 [125, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y460'], ['rr', 'a']] using {} 28,45
 [126, [], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {} 29,45
 [127, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y479'], ['rr', 'a']] using {} 43,45
 [128, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5476'], ['smart', 'a']] using {} 1,46
 [129, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {} 33,46
 [130, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903'], ['smart', 'a']] using {} 1,47
 [131, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']] using {} 33,47
 [132, [], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y8915'], ['smart', 'a']] using {} 1,48
 [133, [], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {} 33,48
 [134, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y3018']] using {} 23,49
 [135, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y']] using {} 25,49
 [136, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y2001']] using {} 28,49
 [137, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y6448']] using {} 43,49
 [138, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y']] using {} 42,50
 [139, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7236'], ['smart', 'a']] using {} 1,51
 [140, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {} 33,51
 [141, [['frustrated', 'b']], [['chase', 'b'], 't'], ['coyote', 'b']], ['rr', 't']] using {'r': 't'} 6,52
 [142, [['frustrated', 'b']], [['chase', 'b'], 't'], ['rr', 't']] using {'u': 't'} 12,53
 [143, [], [['chase', 'b'], 't'], ['coyote', 'b']], ['rr', 't']] using {'u': 't'} 13,53
 [144, [], [['chase', 'b'], 't'], ['rr', 't']] using {'u': 't'} 24,53
 [145, [['frustrated', 'b']], [['rr', 'a']]] using {'u': 'a'} 26,53
 [146, [], [['coyote', 'b']], ['rr', 'a']] using {'u': 'a'} 29,53
 [147, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']] using {} 25,54
 [148, [], [['chase', 'b'], ['a']], ['rr', 'a']] using {'t': 'a'} 24,58
 [149, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'b']] using {} 42,60
 [150, [['catch', 'b'], ['a']], [['coyote', 'y']] using {} 10,62
 [151, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682'], ['smart', 'a']] using {} 62,19
 [152, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['smart', 'a']] using {} 62,22
 [153, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7124'], ['rr', 'a']] using {} 62,45
 [154, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y936']] using {} 62,49
 [155, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['rr', 'a']] using {'u': 'a'} 62,53
 [156, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y']] using {} 62,54
 [157, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y6551'], ['smart', 'a']] using {} 63,19
 [158, [['frustrated', 'b']], [['coyote', 'y'], ['smart', 'a']] using {} 63,22
 [159, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9224'], ['rr', 'a']] using {} 63,45
 [160, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y4682']] using {} 63,49
 [161, [['frustrated', 'b']], [['coyote', 'y'], ['rr', 'a']] using {'u': 'a'} 63,53
 [162, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y']] using {} 63,54
 [163, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']] using {'z': 'b'} 2,64
 [164, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']] using {'x': 'a'} 3,64
 [165, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y7724'], ['smart', 'a']] using {'y': 'b'} 7,64
 [166, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']] using {} 64,8
 [167, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']] using {} 10,64
 [168, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724']] using {} 14,64
 [169, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']] using {} 33,64
 [170, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724']] using {} 42,64
 [171, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y4059']] using {} 1,65
 [172, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y']] using {} 42,66
 [173, [['catch', 'b'], ['a']], []] using {} 10,67
 [174, [], [['chase', 'b'], ['a']], ['smart', 'a']] using {} 67,22
 [175, [], [['beep', 'a']], ['chase', 'b'], ['a']] using {} 67,54

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[176, [], [['rr', 'a']], ['smart', 'a']] using {'u': 'a'}} 68,11
[177, [], [['coyote', 'y'], ['rr', 'a']], ['smart', 'a']] using {} 68,19
[178, [], [['beep', 'a']], ['rr', 'a']] using {'u': 'a'}} 68,20
[179, [], [['beep', 'a']], ['coyote', 'y'], ['rr', 'a']] using {} 68,45
[180, [], [['rr', 'a']]] using {'u': 'a'}} 68,53
[181, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y3719'], ['smart', 'a']] using {} 1,70
[182, [['frustrated', 'b']], ['smart', 'a']] using {} 73,22
[183, [['frustrated', 'b']], ['beep', 'a']] using {} 73,54
[184, [['frustrated', 'b']], ['chase', 'b'], ['a']] using {} 42,75
[185, [['frustrated', 'b']], ['coyote', 'y'], ['coyote', 'y9417'], ['smart', 'a']] using {} 1,77
[186, [], [['coyote', 'b']], ['coyote', 'y'], ['smart', 'a']] using {'w': 'b'}} 79,15
[187, [], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y1136'], ['smart', 'a']] using {} 79,19
[188, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y']] using {'w': 'b'}} 79,38
[189, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y1850'], ['rr', 'a']] using {} 79,45
[190, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3754']] using {} 79,49
[191, [], [['coyote', 'b']], ['coyote', 'y'], ['rr', 'a']] using {'u': 'a'}} 79,53
[192, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y']] using {} 42,80
[193, [], [['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715'], ['smart', 'a']] using {'z': 'b'}} 2,81
[194, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715'], ['rr', 'a']] using {'x': 'a'}} 3,81
[195, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y3715'], ['smart', 'a']] using {} 7,81
[196, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y3715'], ['smart', 'a']] using {'y': 'b'}} 7,81
[197, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715']] using {} 14,81
[198, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715'], ['rr', 'a']] using {} 33,81
[199, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715']] using {} 42,81
[200, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6072']] using {} 1,82
[201, [], [['coyote', 'b'], ['smart', 'a']]] using {} 9,83
[202, [], [['beep', 'a']], ['coyote', 'b']] using {'w': 'b'}} 84,38
[203, [], [['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y2005'], ['smart', 'a']] using {} 1,85
[204, [], [['chase', 'b'], ['a']], ['coyote', 'b']] using {} 42,87
[205, [['frustrated', 'w']], ['beep', 'a'], ['chase', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']] using {'s': 'w', 't': 'a'}} 5,89
[206, [], [['catch', 'w', 'a']], ['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']] using {'r': 'a'}} 6,89
[207, [['frustrated', 'w']], ['beep', 'a'], ['chase', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y']] using {'s': 'w'}} 16,89
[208, [], [['catch', 'w', 'a']], ['coyote', 'w'], ['coyote', 'y']] using {} 17,89
[209, [['frustrated', 'b']], ['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y4552']] using {'w': 'b'}} 23,89
[210, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5832']] using {'w': 'b'}} 28,89
[211, [['frustrated', 'w']], ['beep', 'a'], ['coyote', 'w'], ['coyote', 'y']] using {'s': 'w'}} 39,89
[212, [['frustrated', 'b']], ['beep', 'a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5945']] using {'w': 'b'}} 43,89
[213, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6711']] using {'w': 'b'}} 62,89
[214, [['frustrated', 'b']], ['beep', 'a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y4899']] using {'w': 'b'}} 63,89
[215, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y9011']] using {'w': 'b'}} 79,89
[216, [['frustrated', 'w']], ['coyote', 'w'], ['rr', 'a']] using {'s': 'w'}} 39,91
[217, [['frustrated', 'b']], ['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5876']] using {} 1,92
[218, [], [['catch', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y220']] using {} 93,19
[219, [['frustrated', 'w']], ['chase', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']] using {} 93,35
[220, [['frustrated', 'w']], ['chase', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y']] using {} 93,41
[221, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y2283'], ['rr', 'a']] using {} 93,46
[222, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y7963'], ['rr', 'a']] using {} 93,47
[223, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y4350'], ['rr', 'a']] using {} 93,48
[224, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3276']] using {} 93,50
[225, [['frustrated', 'b']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y8735'], ['rr', 'a']] using {} 93,51
[226, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4697'], ['coyote', 'y7724']] using {} 93,64
[227, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6395']] using {} 93,66
[228, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6783'], ['rr', 'a']] using {} 93,70
[229, [['frustrated', 'b']], ['coyote', 'y'], ['coyote', 'y8357'], ['rr', 'a']] using {} 93,77
[230, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y4985']] using {} 93,80
[231, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3715'], ['coyote', 'y5776']] using {} 93,81
[232, [], [['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5184'], ['rr', 'a']] using {} 93,85
[233, [], [['catch', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y4803']] using {} 1,94
[234, [['frustrated', 'b']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6995'], ['rr', 'a']] using {} 23,94
[235, [], [['chase', 'b'], ['a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6687'], ['rr', 'a']] using {} 28,94
[236, [['frustrated', 'b']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y9952'], ['rr', 'a']] using {} 43,94
[237, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y9619'], ['rr', 'a']] using {} 62,94
[238, [['frustrated', 'b']], ['coyote', 'y'], ['coyote', 'y7028'], ['rr', 'a']] using {} 63,94
[239, [], [['coyote', 'y'], ['rr', 'a']]] using {} 68,94
[240, [], [['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5241'], ['rr', 'a']] using {} 79,94
[241, [['frustrated', 'w']], ['coyote', 'w'], ['coyote', 'y'], ['smart', 'a']] using {'z': 'w'}} 2,99

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[242, [['frustrated', 'w']], [['chase', 'w', 'a']], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y9796']] using {} 93,99
 [243, [['frustrated', 'w']], [['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']]] using {} 93,100
 [244, [['frustrated', 'w']], [['coyote', 'w']]] using {'s': 'w'} 39,103
 [245, [['frustrated', 'b']], [['coyote', 'b']]] using {'w': 'b'} 40,103
 [246, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y']]] using {'w': 'b'} 43,103
 [247, [], [['coyote', 'b']], ['coyote', 'y']]] using {'w': 'b'} 79,103
 [248, [], [['coyote', 'b']]] using {'w': 'b'} 84,103
 [249, [['frustrated', 'w']], [['coyote', 'w'], ['coyote', 'y']]] using {} 93,108
 [250, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5201']]] using {} 93,109
 [251, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y3866']]] using {} 23,114
 [252, [], [['chase', 'b'], ['a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y1051']]] using {} 28,114
 [253, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y4557']]] using {} 43,114
 [254, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y2633']]] using {} 62,114
 [255, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y9426']]] using {} 63,114
 [256, [], [['chase', 'b'], ['a']], ['coyote', 'y']]] using {} 67,114
 [257, [['frustrated', 'b']], [['coyote', 'y']]] using {} 73,114
 [258, [], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y8911']]] using {} 79,114
 [259, [], [['chase', 'b'], ['a']]] using {} 67,115
 [260, [['frustrated', 'b']], []]] using {} 73,115
 [261, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5907'], ['rr', 'a']]] using {'x': 'a'} 3,117
 [262, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y5907'], ['smart', 'a']]] using {} 7,117
 [263, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y5907'], ['smart', 'a']]] using {'y': 'b'} 7,117
 [264, [], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5907'], ['smart', 'a']]] using {} 117,8
 [265, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y5907']]] using {} 14,117
 [266, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5907'], ['rr', 'a']]] using {} 33,117
 [267, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y5907']]] using {} 42,117
 [268, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y3695'], ['coyote', 'y5907']]] using {} 93,117
 [269, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y3487']]] using {} 1,118
 [270, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {'s':
 'b'}, 't': 'a'} 5,121
 [271, [], [['catch', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {'r': 'a'} 6,121
 [272, [], [['beep', 'a']], ['catch', 'b'], ['a'], ['coyote', 'y6970']]] using {'y': 'b'} 7,121
 [273, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {'t': 'a'}
 12,121
 [274, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {'t': 'a'}
 13,121
 [275, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970']]] using {'s': 'b'}
 16,121
 [276, [], [['catch', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 17,121
 [277, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {} 18,121
 [278, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4610'], ['coyote', 'y6970']]] using {}
 23,121
 [279, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {'t': 'a'} 24,121
 [280, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 25,121
 [281, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {} 26,121
 [282, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970'], ['coyote', 'y9562']]] using {} 28,121
 [283, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {} 29,121
 [284, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 31,121
 [285, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970']]] using {'s': 'b'} 39,121
 [286, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y1803'], ['coyote', 'y6970']]] using {} 43,121
 [287, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4373'], ['coyote', 'y6970']]] using {} 62,121
 [288, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y2834'], ['coyote', 'y6970']]] using {} 63,121
 [289, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 67,121
 [290, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6970'], ['rr', 'a']]] using {} 68,121
 [291, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 73,121
 [292, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y2418'], ['coyote', 'y6970']]] using {} 79,121
 [293, [], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y6970']]] using {} 84,121
 [294, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y532'], ['coyote', 'y9593']]] using {}
 1,122
 [295, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y9593'], ['rr', 'a']]] using {'z': 'b'} 2,122
 [296, [['frustrated', 'b']], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y9593'], ['rr', 'a']]] using {'r': 'a'} 6,122
 [297, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y9593'], ['rr', 'a']]] using {'y': 'b'} 7,122
 [298, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y9593'], ['rr', 'a']]] using {} 122,8
 [299, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y9593']]] using {} 9,122
 [300, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9593'], ['rr', 'a']]] using {} 10,122
 [301, [], [['beep', 'a']], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y7830']]] using {} 1,123


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[302, [['frustrated', ['b']], ['beep', ['a']], ['coyote', 'y'], ['coyote', 'y1506']]] using {} 1,124
[303, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y4390'], ['coyote', 'y460']]] using {} 1,125
[304, [], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y460'], ['rr', ['a']]] using {'z': ['b']} 2,125
[305, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y460'], ['rr', ['a']]] using {'r': ['a']} 6,125
[306, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y460'], ['rr', ['a']]] using {} 7,125
[307, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y460'], ['rr', ['a']]] using {'y': ['b']} 7,125
[308, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y460']]] using {} 9,125
[309, [], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y701']]] using {} 1,126
[310, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y4002'], ['coyote', 'y479']]] using {} 1,127
[311, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y479'], ['rr', ['a']]] using {'r': ['a']} 6,127
[312, [['frustrated', ['b']], ['beep', ['a']], ['coyote', 'y'], ['coyote', 'y479'], ['rr', ['a']]] using {} 7,127
[313, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y479'], ['rr', ['a']]] using {'y': ['b']} 7,127
[314, [], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y479'], ['rr', ['a']]] using {} 127,8
[315, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y479']]] using {} 9,127
[316, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476'], ['smart', ['a']]] using {'z': ['b']} 2,128
[317, [['frustrated', ['b']], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476'], ['rr', ['a']]] using {'x': ['a']} 3,128
[318, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y5476'], ['smart', ['a']]] using {} 7,128
[319, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y5476'], ['smart', ['a']]] using {'y': ['b']} 7,128
[320, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476'], ['smart', ['a']]] using {} 128,8
[321, [['frustrated', ['b']], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476']]] using {} 14,128
[322, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476'], ['rr', ['a']]] using {} 33,128
[323, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y5476']]] using {} 42,128
[324, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y1277'], ['coyote', 'y5476']]] using {} 93,128
[325, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y1211']]] using {} 1,129
[326, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y2903'], ['smart', ['a']]] using {'z': ['b']} 2,130
[327, [['frustrated', ['b']], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903'], ['rr', ['a']]] using {'x': ['a']} 3,130
[328, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y2903'], ['smart', ['a']]] using {'y': ['b']} 7,130
[329, [], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903'], ['smart', ['a']]] using {} 130,8
[330, [['frustrated', ['b']], ['coyote', 'y'], ['coyote', 'y2903'], ['smart', ['a']]] using {} 10,130
[331, [['frustrated', ['b']], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903']]] using {} 14,130
[332, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903'], ['rr', ['a']]] using {} 33,130
[333, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903']]] using {} 42,130
[334, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2903'], ['coyote', 'y8827']]] using {} 93,130
[335, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y6669']]] using {} 1,131
[336, [], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y8915'], ['smart', ['a']]] using {'z': ['b']} 2,132
[337, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y8915'], ['rr', ['a']]] using {'x': ['a']} 3,132
[338, [], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y8915'], ['smart', ['a']]] using {} 7,132
[339, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y8915'], ['smart', ['a']]] using {'y': ['b']} 7,132
[340, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y8915']]] using {} 14,132
[341, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y8915'], ['rr', ['a']]] using {} 33,132
[342, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y8915']]] using {} 42,132
[343, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y287'], ['coyote', 'y8915']]] using {} 93,132
[344, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y2121']]] using {} 1,133
[345, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y3018']]] using {'z': ['b']} 2,134
[346, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y3018'], ['rr', ['a']]] using {'r': ['a']} 6,134
[347, [['frustrated', ['b']], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y3018']]] using {'y': ['b']} 7,134
[348, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y3018']]] using {} 134,8
[349, [['frustrated', ['b']], ['beep', ['a']], ['coyote', 'y'], ['coyote', 'y3018']]] using {} 10,134
[350, [['frustrated', ['b']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y3018']]] using {} 17,134
[351, [], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y2001']]] using {'z': ['b']} 2,136
[352, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y2001'], ['rr', ['a']]] using {'r': ['a']} 6,136
[353, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y2001']]] using {} 7,136
[354, [], ['beep', ['a']], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y2001']]] using {'y': ['b']} 7,136
[355, [], ['chase', ['b'], ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y2001']]] using {} 17,136
[356, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y6448'], ['rr', ['a']]] using {'r': ['a']} 6,137
[357, [['frustrated', ['b']], ['beep', ['a']], ['coyote', 'y'], ['coyote', 'y6448']]] using {} 7,137
[358, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y6448']]] using {'y': ['b']} 7,137
[359, [], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y6448']]] using {} 137,8
[360, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y6448']]] using {} 17,137
[361, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y7236'], ['rr', ['a']]] using {'x': ['a']} 3,139
[362, [['frustrated', ['b']], ['coyote', 'y'], ['coyote', 'y7236'], ['smart', ['a']]] using {} 7,139
[363, [['frustrated', ['b']], ['coyote', ['b']], ['coyote', 'y7236'], ['smart', ['a']]] using {'y': ['b']} 7,139
[364, [], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y7236'], ['smart', ['a']]] using {} 139,8
[365, [['frustrated', ['b']], ['beep', ['a']], ['coyote', ['b']], ['coyote', 'y'], ['coyote', 'y7236']]] using {} 14,139

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[366, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7236'], ['rr', 'a']]] using {} 33,139
 [367, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7236']] using {} 42,139
 [368, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y692'], ['coyote', 'y7236']] using {} 93,139
 [369, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y2135']] using {} 1,140
 [370, [], [['coyote', 'y'], ['coyote', 'y352'], ['smart', 'a']]] using {} 150,19
 [371, [], [['coyote', 'y'], ['smart', 'a']]] using {} 150,22
 [372, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9817'], ['rr', 'a']]] using {} 150,45
 [373, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9710']] using {} 150,49
 [374, [], [['beep', 'a']], ['coyote', 'y']] using {} 150,54
 [375, [], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y6976']] using {'w': 'b'}} 150,89
 [376, [], [['coyote', 'y'], ['coyote', 'y5543'], ['rr', 'a']]] using {} 150,94
 [377, [], [['coyote', 'y'], ['coyote', 'y1755']] using {} 150,114
 [378, [], [['coyote', 'y']]] using {} 150,115
 [379, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y1079'], ['coyote', 'y6970']] using {} 150,121
 [380, [], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y6682'], ['smart', 'a']]] using {'z': 'b'}} 2,151
 [381, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682'], ['rr', 'a']]] using {'x': 'a'}} 3,151
 [382, [], [['chase', 'b'], ['a']], ['coyote', 'y6682'], ['smart', 'a']]] using {'y': 'b'}} 7,151
 [383, [], [['coyote', 'y'], ['coyote', 'y6682'], ['smart', 'a']]] using {} 10,151
 [384, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682']] using {} 14,151
 [385, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682'], ['rr', 'a']]] using {} 33,151
 [386, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682']] using {} 42,151
 [387, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y6682'], ['coyote', 'y8497']] using {} 93,151
 [388, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y5568']] using {} 93,152
 [389, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y1125'], ['coyote', 'y7124']] using {} 1,153
 [390, [], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7124'], ['rr', 'a']]] using {'z': 'b'}} 2,153
 [391, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7124'], ['rr', 'a']]] using {'r': 'a'}} 6,153
 [392, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y7124'], ['rr', 'a']]] using {'y': 'b'}} 7,153
 [393, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7124']] using {} 9,153
 [394, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y7124'], ['rr', 'a']]] using {} 10,153
 [395, [], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y936']] using {'z': 'b'}} 2,154
 [396, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y936'], ['rr', 'a']]] using {'r': 'a'}} 6,154
 [397, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y936']] using {'y': 'b'}} 7,154
 [398, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y936']] using {} 10,154
 [399, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y936']] using {} 17,154
 [400, [], [['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y837']] using {} 1,155
 [401, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6551'], ['rr', 'a']]] using {'x': 'a'}} 3,157
 [402, [['frustrated', 'b']], [['coyote', 'y6551'], ['smart', 'a']]] using {'y': 'b'}} 7,157
 [403, [], [['coyote', 'y'], ['coyote', 'y6551'], ['smart', 'a']]] using {} 157,8
 [404, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6551']] using {} 14,157
 [405, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y6551'], ['rr', 'a']]] using {} 33,157
 [406, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y6551']] using {} 42,157
 [407, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y3584'], ['coyote', 'y6551']] using {} 93,157
 [408, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y8805']] using {} 93,158
 [409, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y6126'], ['coyote', 'y9224']] using {} 1,159
 [410, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y9224'], ['rr', 'a']]] using {'r': 'a'}} 6,159
 [411, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y9224'], ['rr', 'a']]] using {'y': 'b'}} 7,159
 [412, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9224'], ['rr', 'a']]] using {} 159,8
 [413, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y9224']] using {} 9,159
 [414, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y4682'], ['rr', 'a']]] using {'r': 'a'}} 6,160
 [415, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y4682']] using {'y': 'b'}} 7,160
 [416, [], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y4682']] using {} 160,8
 [417, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y4682']] using {} 17,160
 [418, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y2699']] using {} 1,161
 [419, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {'x': 'a'}} 3,163
 [420, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y7724'], ['smart', 'a']]] using {'y': 'b'}} 7,163
 [421, [], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']]] using {} 163,8
 [422, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724']] using {} 14,163
 [423, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 33,163
 [424, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y7724']] using {} 42,163
 [425, [['frustrated', 'b']], [['coyote', 'b']], ['coyote', 'y'], ['coyote', 'y1709'], ['coyote', 'y7724']] using {} 93,163
 [426, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['coyote', 'y9948']] using {}
 1,164
 [427, [['frustrated', 'b']], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y7724'], ['rr', 'a']]] using {'y': 'b'}} 7,164
 [428, [], [['beep', 'a']], ['chase', 'b'], ['a']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 164,8
 [429, [['frustrated', 'b']], [['beep', 'a']], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 10,164
 [430, [], [['chase', 'b'], ['a']], ['coyote', 'y7724'], ['smart', 'a']]] using {} 165,8

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[431, [['frustrated', 'b']], [['coyote', 'y7724'], ['smart', 'a']]] using {} 10,165
[432, [['frustrated', 'b']], [['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'y7724']]] using {} 14,165
[433, [['frustrated', 'b']], [['chase', 'b'], ['a'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 33,165
[434, [['frustrated', 'b']], [['chase', 'b'], ['a'], ['coyote', 'y7724']]] using {} 42,165
[435, [], [['coyote', 'y'], ['coyote', 'y7724'], ['smart', 'a']]] using {} 10,166
[436, [], [['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y7724']]] using {} 14,166
[437, [], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 33,166
[438, [], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y7724']]] using {} 42,166
[439, [], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y5694'], ['coyote', 'y7724']]] using {} 93,166
[440, [['frustrated', 'b']], [['beep', 'a'], ['coyote', 'y'], ['coyote', 'y7724']]] using {} 14,167
[441, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y7724'], ['rr', 'a']]] using {} 33,167
[442, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y7724']]] using {} 42,167
[443, [['frustrated', 'b']], [['coyote', 'y'], ['coyote', 'y1575'], ['coyote', 'y7724']]] using {} 93,167
[444, [['frustrated', 'b']], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y147'], ['coyote', 'y7724']]] using {} 1,169
[445, [['frustrated', 'b']], [['beep', 'a'], ['coyote', 'b'], ['coyote', 'y'], ['coyote', 'y4059']]] using {'z': 'b'} 2,171
[446, [['frustrated', 'b']], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4059'], ['rr', 'a']]] using {'r': 'a'} 6,171
[447, [['frustrated', 'b']], [['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'y4059']]] using {'y': 'b'} 7,171
[448, [], [['beep', 'a'], ['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4059']]] using {} 171,8
[449, [['frustrated', 'b']], [['beep', 'a'], ['coyote', 'y'], ['coyote', 'y4059']]] using {} 10,171
[450, [['frustrated', 'b']], [['chase', 'b'], ['a'], ['coyote', 'y'], ['coyote', 'y4059']]] using {} 17,171
[451, [], [['smart', 'a']]] using {} 173,22
[452, [], [['beep', 'a']]] using {} 173,54
FINAL RES: 173,115('NUMBER OF STEPS:', 452)

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TWO POINTER RESOLUTION STEPS FOR Harmonia

```

[1, [['grandparent', 'x', 'y'], ['parent', 'x', 'z'], ['parent', 'z', 'y']]]
[2, [['parent', 'x', 'y'], ['mother', 'x', 'y']]]
[3, [['parent', 'x', 'y'], ['father', 'x', 'y']]]
[4, [['father', 'Zeus'], ['Ares']]]
[5, [['mother', 'Hera'], ['Ares']]]
[6, [['father', 'Ares'], ['Harmonia']]]
[7, [], [['grandparent', 'x', 'Harmonia']]]
[8, [], [['parent', 'x', 'z'], ['parent', 'z', 'Harmonia']]] using {'y': 'Harmonia'} 1,7
[9, [], [['mother', 'x', 'y'], ['parent', 'y', 'Harmonia']]] using {'z': 'y'} 2,8
[10, [], [['mother', 'z', 'Harmonia'], ['parent', 'z', 'z']]] using {'y': 'Harmonia', 'x': 'z'} 2,8
[11, [], [['father', 'x', 'y'], ['parent', 'y', 'Harmonia']]] using {'z': 'y'} 3,8
[12, [], [['father', 'z', 'Harmonia'], ['parent', 'z', 'z']]] using {'y': 'Harmonia', 'x': 'z'} 3,8
[13, [], [['mother', 'y8731', 'Harmonia'], ['mother', 'y8731', 'y8731']]] using {'y': 'Harmonia', 'x': 'y8731'} 2,9
[14, [], [['father', 'y8256', 'Harmonia'], ['mother', 'y8256', 'y8256']]] using {'y': 'Harmonia', 'x': 'y8256'} 3,9
[15, [], [['parent', 'Ares'], ['Harmonia']]] using {'y': 'Ares', 'x': 'Hera'} 5,9
[16, [], [['mother', 'y', 'Harmonia'], ['mother', 'y', 'y']]] using {'x': 'y', 'z': 'y'} 2,10
[17, [], [['father', 'y', 'y'], ['mother', 'y', 'Harmonia']]] using {'x': 'y', 'z': 'y'} 3,10
[18, [], [['father', 'y6874', 'y6874'], ['mother', 'y6874', 'Harmonia']]] using {'y': 'Harmonia', 'x': 'y6874'} 2,11
[19, [], [['father', 'y7075', 'Harmonia'], ['father', 'y7075', 'y7075']]] using {'y': 'Harmonia', 'x': 'y7075'} 3,11
[20, [], [['parent', 'Harmonia'], ['Harmonia']]] using {'y': 'Harmonia', 'x': 'Ares'} 6,11
[21, [], [['father', 'y', 'Harmonia'], ['mother', 'y', 'y']]] using {'x': 'y', 'z': 'y'} 2,12
[22, [], [['father', 'y', 'Harmonia'], ['father', 'y', 'y']]] using {'x': 'y', 'z': 'y'} 3,12
[23, [], [['parent', 'Ares'], ['Ares']]] using {'z': 'Ares'} 6,12
[24, [], [['mother', 'Ares'], ['Ares']]] using {'y8256': 'Ares'} 6,14
[25, [], [['mother', 'Ares'], ['Harmonia']]] using {'y': 'Harmonia', 'x': 'Ares'} 2,15
[26, [], [['father', 'Ares'], ['Harmonia']]] using {'y': 'Harmonia', 'x': 'Ares'} 3,15
[27, [], [['father', 'Ares'], ['Ares']]] using {'y7075': 'Ares'} 6,19
[28, [], [['mother', 'Harmonia'], ['Harmonia']]] using {'y': 'Harmonia', 'x': 'Harmonia'} 2,20
[29, [], [['father', 'Harmonia'], ['Harmonia']]] using {'y': 'Harmonia', 'x': 'Harmonia'} 3,20
FINAL RES: 6,26('NUMBER OF STEPS:', 29)

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TWO POINTER RESOLUTION STEPS FOR Test

```

[1, [['P', 'x', 'BETA'], ['Q', 'x'], ['S', 'y', 'res']]]
[2, [['R', 'x'], ['T', 'x']], [['P', 'x', 'w']]]
[3, [['R', 'x'], ['Q', 'x']]]

```

```

[4, [['S', 'y', ['ZETA']], ['R', 'x']]]
[5, [], [['S', 'y', ['ZETA']]]]
[6, [], [['T', 'x']]]
[7, [['P', 'x', ['BETA']], ['Q', 'x']], []] using {'res': ['ZETA']} 1,5
[8, [], [['R', 'x']]] using {} 4,5
[9, [['R', 'x']], [['P', 'x', 'w']]] using {} 2,6
[10, [['Q', 'x'], ['R', 'x'], ['T', 'x']], []] using {'x395': 'x', 'w': ['BETA']} 7,2
[11, [['P', 'x', ['BETA']], ['R', 'x']], []] using {'x7620': 'x'} 7,3
[12, [['T', 'x']], [['P', 'x', 'w']]] using {} 2,8
[13, [], [['Q', 'x']]] using {} 3,8
[14, [['Q', 'x5866'], ['R', 'x5866'], ['S', 'y', 'res']], []] using {'x': 'x5866', 'w': ['BETA']} 1,9
[15, [['S', 'y', ['ZETA']], [['P', 'x', 'w']]] using {'x4083': 'x'} 9,4
[16, [['Q', 'x7257'], ['R', 'x7257']], []] using {'x': 'x7257', 'w': ['BETA']} 7,9
[17, [], [['P', 'x', 'w']]] using {} 9,8
[18, [['R', 'x'], ['T', 'x']], []] using {'x7951': 'x'} 10,3
[19, [['Q', 'x'], ['S', 'y', ['ZETA']], ['T', 'x']], []] using {'x5884': 'x'} 10,4
[20, [['Q', 'x'], ['R', 'x']], []] using {} 10,6
[21, [['Q', 'x'], ['T', 'x']], []] using {} 10,8
[22, [['P', 'x', ['BETA']], ['S', 'y', ['ZETA']]], []] using {'x6134': 'x'} 11,4
[23, [['P', 'x', ['BETA']]], []] using {} 11,8
[24, [['R', 'x']], []] using {'w': ['BETA'], 'x2162': 'x'} 11,9
[25, [['Q', 'x8812'], ['S', 'y', 'res'], ['T', 'x8812']], []] using {'x': 'x8812', 'w': ['BETA']} 1,12
[26, [['Q', 'x3086'], ['T', 'x3086']], []] using {'x': 'x3086', 'w': ['BETA']} 7,12
[27, [['R', 'x7621'], ['T', 'x7621']], []] using {'x': 'x7621', 'w': ['BETA']} 11,12
[28, [['P', 'x', ['BETA']], ['S', 'y', 'res']], []] using {} 1,13
[29, [['R', 'x'], ['S', 'y', 'res']], []] using {'x5866': 'x'} 14,3
[30, [['Q', 'x'], ['S', 'y', ['ZETA']], ['S', 'y', 'res']], []] using {'x5866': 'x'} 14,4
[31, [['Q', 'x5866'], ['R', 'x5866']], []] using {'res': ['ZETA']} 14,5
[32, [['Q', 'x'], ['S', 'y', 'res']], []] using {'x5866': 'x'} 14,8
[33, [['Q', 'x1500'], ['S', 'y', ['ZETA']], ['S', 'y', 'res']], []] using {'x': 'x1500', 'w': ['BETA']} 1,15
[34, [['Q', 'x2329'], ['S', 'y', ['ZETA']]], []] using {'x': 'x2329', 'w': ['BETA']} 7,15
[35, [['R', 'x6344'], ['S', 'y', ['ZETA']]], []] using {'x': 'x6344', 'w': ['BETA']} 11,15
[36, [['Q', 'x'], ['S', 'y', ['ZETA']]], []] using {'x7257': 'x'} 16,4
[37, [['Q', 'x']], []] using {'x7257': 'x'} 16,8
[38, [['S', 'y', ['ZETA']], ['T', 'x']], []] using {'x3105': 'x'} 18,4
[39, [['T', 'x']], []] using {} 18,8
[40, [['R', 'x'], ['S', 'y', ['ZETA']], ['T', 'x']], []] using {'x3321': 'x'} 19,3
[41, [['R', 'x'], ['S', 'y', ['ZETA']]], []] using {'w': ['BETA']} 22,9
[42, [['S', 'y', ['ZETA']]], []] using {'w': ['BETA']} 22,15
FINAL RES: 23,17('NUMBER OF STEPS:', 42)

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UNIT PREFERENCE RESOLUTION STEPS FOR Howling

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[1, [['howl', 'z']], [['hound', 'z']]]
[2, [], [['have', 'x', 'y'], ['cat', 'y'], ['have', 'x', 'z'], ['mouse', 'z']]]
[3, [], [['ls', 'w'], ['have', 'w', 'v'], ['howl', 'v']]]
[4, [['have', ['john'], ['a']]], []]
[5, [['cat', ['a']], ['hound', ['a']]], []]
[6, [['mouse', ['b']]], []]
[7, [['ls', ['john']]], []]
[8, [['have', ['john'], ['b']]], []]
[9, [['cat', ['a']], ['howl', ['a']]], []] using {'z': ['a']} 5,1
[10, [], [['howl', ['a']], ['ls', ['john']]]] using {'w': ['john'], 'v': ['a']} 4,3
[11, [], [['howl', ['a']]]] using {} 7,10
[12, [], [['hound', ['a']]]] using {'z': ['a']} 1,11

```

```

[13, [['cat', 'a']], [] using {} 5,12
[14, [], [['hound', 'a']], ['ls', 'john']] using {'z': 'a'} 1,10
[15, [['cat', 'a']], ['ls', 'john']] using {} 9,10
[16, [], [['have', 'john'], 'v'], ['howl', 'v']] using {'w': 'john'} 7,3
[17, [], [['howl', 'b']]] using {'v': 'b'} 8,16
[18, [], [['hound', 'b']]] using {'z': 'b'} 1,17
[19, [], [['have', 'john'], 'v'], ['hound', 'v']] using {'z': 'v'} 1,16
[20, [['cat', 'a']], [['have', 'john'], 'a']] using {'v': 'a'} 9,16
[21, [], [['howl', 'b']], ['ls', 'john']] using {'w': 'john', 'v': 'b'} 8,3
[22, [], [['hound', 'b']], ['ls', 'john']] using {'z': 'b'} 1,21
[23, [], [['have', 'w', 'v'], ['hound', 'v'], ['ls', 'w']]] using {'z': 'v'} 1,3
[24, [['cat', 'a']], [['have', 'w', 'a']], ['ls', 'w']]] using {'v': 'a'} 9,3
[25, [], [['cat', 'a']], ['have', 'john'], 'z'], ['mouse', 'z']] using {'y': 'a', 'x': 'john'} 4,2
[26, [], [['cat', 'y'], ['have', 'john'], 'y'], ['mouse', 'a']] using {'x': 'john', 'z': 'a'} 4,2
[27, [], [['cat', 'a']], ['mouse', 'a']] using {'z': 'a'} 4,25
[28, [], [['cat', 'b']]] using {'a': 'b'} 6,27
FINAL RES: 13,28('NUMBER OF STEPS:', 28)

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UNIT PREFERENCE RESOLUTION STEPS FOR Custom

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[1, [['v', 'x'], ['s', 'x'], ['f', 'x']], [['e', 'x']]]
[2, [['v', 'y'], ['c', 'f', 'y']], [['e', 'y']]]
[3, [['e', 'a']], []]
[4, [['d', 'a']], []]
[5, [['d', 'z']], [['s', 'a', 'z']]]
[6, [], [['d', 'w'], ['v', 'w']]]
[7, [], [['d', 'r'], ['c', 'r']]]
[8, [], [['v', 'a']]] using {'w': 'a'} 4,6
[9, [], [['s', 'a'], ['a', 'w'], ['v', 'w']]] using {'z': 'w'} 5,6
[10, [], [['c', 'a']]] using {'r': 'a'} 4,7
[11, [], [['c', 'r'], ['s', 'a', 'r']]] using {'z': 'r'} 5,7
[12, [['s', 'a'], ['f', 'a']], ['v', 'a']], []] using {'x': 'a'} 3,1
[13, [['s', 'a'], ['f', 'a']], []] using {} 12,8
[14, [['d', 'f', 'a']], []] using {'z': 'f', 'a'}} 13,5
[15, [], [['v', 'f', 'a']]] using {'w': 'f', 'a'}} 14,6
[16, [], [['c', 'f', 'a']]] using {'r': 'f', 'a'}} 14,7
[17, [['d', 'f', 'a']], ['v', 'a']], []] using {'z': 'f', 'a'}} 12,5
[18, [['s', 'a'], ['f', 'a']], ['d', 'a']]] using {'w': 'a'} 12,6
[19, [['v', 'a']]], ['v', 'f', 'a']]] using {'w': 'f', 'a'}} 12,9
[20, [['s', 'a'], ['f', 'a']], ['s', 'a'], ['a']]] using {'w': 'a'} 12,9
[21, [['v', 'a']]], ['c', 'f', 'a']]] using {'r': 'f', 'a'}} 12,11
[22, [['d', 'f', 'a']]], ['d', 'a']]] using {'w': 'a'} 17,6
[23, [['d', 'f', 'a']]], ['s', 'a'], ['a']]] using {'w': 'a'} 17,9
[24, [], [['d', 'a']], ['v', 'f', 'a']]] using {'w': 'f', 'a'}} 18,9
[25, [], [['c', 'f', 'a']], ['d', 'a']]] using {'r': 'f', 'a'}} 18,11
[26, [], [['s', 'a'], ['a', 'a']], ['v', 'f', 'a']]] using {'w': 'a'} 19,9
[27, [], [['c', 'f', 'a']], ['s', 'a'], ['a']]] using {'r': 'f', 'a'}} 20,11
[28, [['s', 'a'], ['f', 'a']], ['e', 'a']]] using {'x': 'a'} 1,8
[29, [['d', 'f', 'a']]], ['e', 'a']]] using {'z': 'f', 'a'}} 28,5
[30, [], [['e', 'a']], ['v', 'f', 'a']]] using {'w': 'f', 'a'}} 28,9
[31, [], [['c', 'f', 'a']], ['e', 'a']]] using {'r': 'f', 'a'}} 28,11
[32, [['s', 'f', 'a']], ['f', 'f', 'a']]], [['e', 'f', 'a']]] using {'x': 'f', 'a'}} 1,15
[33, [['d', 'f', 'a']], ['v', 'a']], [['e', 'a']]] using {'x': 'a', 'z': 'f', 'a'}} 1,5
[34, [['s', 'w', 'f', 'w']]], ['d', 'w'], ['e', 'w']]] using {'x': 'w'} 1,6
[35, [['v', 'a']]], [['e', 'a']], ['v', 'f', 'a']]] using {'x': 'a', 'w': 'f', 'a'}} 1,9
[36, [['s', 'w', 'f', 'a']]], [['e', 'w'], ['s', 'a', 'w']]] using {'x': 'w'} 1,9
[37, [['v', 'a']]], [['c', 'f', 'a']], ['e', 'a']]] using {'x': 'a', 'r': 'f', 'a'}} 1,11
[38, [['s', 'f', 'a']], ['f', 'f', 'a']]], ['v', 'a']]], ['e', 'f', 'a']]] using {'x': 'f', 'a'}} 1,19
[39, [['s', 'f', 'a']], ['f', 'f', 'a']]], [['d', 'a']], ['e', 'f', 'a']]] using {'x': 'f', 'a'}} 1,24
[40, [['s', 'f', 'a']], ['f', 'a']]], [['e', 'f', 'a']], ['s', 'a'], ['a']]] using {'x': 'f', 'a'}} 1,26
[41, [['s', 'f', 'a']], ['f', 'f', 'a']]], [['e', 'a']], ['e', 'f', 'a']]] using {'x': 'f', 'a'}} 1,30
[42, [['c', 'f', 'a']]], ['v', 'a']]], []] using {'y': 'a'} 3,2
[43, [['c', 'f', 'a']]], []] using {} 42,8
FINAL RES: 43,16('NUMBER OF STEPS:', 43)

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UNIT PREFERENCE RESOLUTION STEPS FOR Roadrunner

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[1, [['rr', 'a']], [['coyote', 'y']]
[2, [['chase', 'z', 'a']], [['coyote', 'z']]
[3, [['smart', 'x']], [['rr', 'x'], ['beep', 'x']]
[4, [], [['coyote', 'w'], ['rr', 'u'], ['catch', 'w', 'u'], ['smart', 'u']]]
[5, [['frustrated', 's'], ['catch', 's', 't']], [['coyote', 's'], ['rr', 't'], ['chase', 's', 't']]]
[6, [['beep', 'r']], [['rr', 'r']]]
[7, [['coyote', 'b']], []]
[8, [], [['frustrated', 'b']]]
[9, [['rr', 'a']], []] using {'y': ['b']} 7,1
[10, [['chase', 'b'], ['a']], []] using {'z': ['b']} 7,2
[11, [['beep', 'a']], []] using {'r': ['a']} 9,6
[12, [['beep', 'a']], [['coyote', 'y']]] using {'r': ['a']} 1,6
[13, [['smart', 'a']], [['beep', 'a']]] using {'x': ['a']} 9,3
[14, [['smart', 'a']], []] using {} 11,13
[15, [['smart', 'a']], [['rr', 'a']]] using {'r': ['a']} 6,13
[16, [['smart', 'a']], [['coyote', 'y']]] using {} 12,13
[17, [['smart', 'a']], [['beep', 'a'], ['coyote', 'y']]] using {'x': ['a']} 1,3
[18, [['smart', 'x']], [['rr', 'x']]] using {'r': ['x']} 6,3
[19, [['smart', 'a']], [['coyote', 'y'], ['rr', 'a']]] using {'x': ['a']} 12,3
[20, [['smart', 'a']], [['coyote', 'y'], ['coyote', 'y4747']]] using {} 12,17
[21, [['smart', 'a']], [['coyote', 'y'], ['coyote', 'y549']]] using {} 1,19
[22, [['smart', 'a']], [['coyote', 'y4747']]] using {'y': ['b']} 7,20
[23, [['smart', 'a']], [['coyote', 'y549']]] using {'y': ['b']} 7,21
[24, [], [['catch', 'b'], 'u'], ['rr', 'u'], ['smart', 'u']]] using {'w': ['b']} 7,4
[25, [], [['catch', 'b'], 'a'], ['smart', 'a']]] using {'u': ['a']} 9,24
[26, [], [['catch', 'b'], 'a']]] using {} 14,25
[27, [], [['beep', 'a'], ['catch', 'b'], 'a']]] using {} 13,25
[28, [], [['catch', 'b'], 'a'], ['rr', 'a']]] using {} 15,25
[29, [], [['catch', 'b'], 'a'], ['coyote', 'y']]] using {} 16,25
[30, [], [['catch', 'b'], 'a'], ['coyote', 'y4747']]] using {} 22,25
[31, [], [['catch', 'b'], 'a'], ['coyote', 'y549']]] using {} 23,25
[32, [], [['beep', 'a'], ['catch', 'b'], 'a'], ['rr', 'a']]] using {'x': ['a']} 3,25
[33, [], [['beep', 'a'], ['catch', 'b'], 'a'], ['coyote', 'y']]] using {} 17,25
[34, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['rr', 'a']]] using {} 19,25
[35, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y4747']]] using {} 20,25
[36, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y549']]] using {} 21,25
[37, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['smart', 'a']]] using {'u': ['a']} 1,24
[38, [], [['catch', 'b'], 'u'], ['rr', 'u']]] using {'x': ['u']} 18,24
[39, [], [['catch', 'b'], 'a'], ['coyote', 'y4747'], ['rr', 'a']]] using {'u': ['a']} 22,24
[40, [], [['catch', 'b'], 'a'], ['coyote', 'y549'], ['rr', 'a']]] using {'u': ['a']} 23,24
[41, [], [['beep', 'u'], ['catch', 'b'], 'u'], ['rr', 'u']]] using {'x': ['u']} 3,24
[42, [], [['beep', 'a'], ['catch', 'b'], 'a'], ['coyote', 'y'], ['rr', 'a']]] using {'u': ['a']} 17,24
[43, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y4747'], ['rr', 'a']]] using {'u': ['a']} 20,24
[44, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y549'], ['rr', 'a']]] using {'u': ['a']} 21,24
[45, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y9021']]] using {} 12,33
[46, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y3895']]] using {} 1,34
[47, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y6157']]] using {} 16,37
[48, [], [['beep', 'a'], ['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y6171']]] using {} 17,37
[49, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y6841'], ['rr', 'a']]] using {} 19,37
[50, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y4747'], ['coyote', 'y7442']]] using {} 20,37
[51, [], [['catch', 'b'], 'a'], ['coyote', 'y'], ['coyote', 'y4404'], ['coyote', 'y549']]] using {} 21,37
[52, [], [['catch', 'b'], 'a'], ['coyote', 'y9021']]] using {'y': ['b']} 7,45
[53, [], [['catch', 'b'], 'a'], ['coyote', 'y3895']]] using {'y': ['b']} 7,46
[54, [], [['catch', 'b'], 'a'], ['coyote', 'y6157']]] using {'y': ['b']} 7,47
[55, [], [['catch', 'w', 'a'], ['coyote', 'w'], ['smart', 'a']]] using {'u': ['a']} 9,4
[56, [], [['catch', 'w', 'a'], ['coyote', 'w']]] using {} 14,55
[57, [], [['beep', 'a'], ['catch', 'w', 'a'], ['coyote', 'w']]] using {} 13,55
[58, [], [['catch', 'w', 'a'], ['coyote', 'w'], ['rr', 'a']]] using {} 15,55
[59, [], [['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y']]] using {} 16,55
[60, [], [['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y4747']]] using {} 22,55
[61, [], [['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y549']]] using {} 23,55
[62, [], [['beep', 'a'], ['catch', 'w', 'a'], ['coyote', 'w'], ['rr', 'a']]] using {'x': ['a']} 3,55

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[63, [], ['beep', 'a'], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y']] using {} 17,55
[64, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']] using {} 19,55
[65, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y4747']] using {} 20,55
[66, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y549']] using {} 21,55
[67, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['smart', 'a']] using {'u': 'a'} 1,4
[68, [], ['catch', 'w', 'u'], ['coyote', 'w'], ['rr', 'u']] using {'x': 'u'} 18,4
[69, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y4747'], ['rr', 'a']] using {'u': 'a'} 22,4
[70, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y549'], ['rr', 'a']] using {'u': 'a'} 23,4
[71, [], ['beep', 'u'], ['catch', 'w', 'u'], ['coyote', 'w'], ['rr', 'u']] using {'x': 'u'} 3,4
[72, [], ['beep', 'a'], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['rr', 'a']] using {'u': 'a'} 17,4
[73, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y4747'], ['rr', 'a']] using {'u': 'a'} 20,4
[74, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y549'], ['rr', 'a']] using {'u': 'a'} 21,4
[75, [], ['beep', 'a'], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y133']] using {} 1,42
[76, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y4825'], ['rr', 'a']] using {} 12,42
[77, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y4747'], ['coyote', 'y8018']] using {} 1,43
[78, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y2267'], ['coyote', 'y549']] using {} 1,44
[79, [], ['beep', 'a'], ['catch', 'b', 'a'], ['coyote', 'y6171']] using {'y': 'b'} 7,48
[80, [], ['catch', 'b', 'a'], ['coyote', 'y6171']] using {} 11,79
[81, [], ['catch', 'b', 'a'], ['coyote', 'y6171'], ['rr', 'a']] using {'r': 'a'} 6,79
[82, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y6171']] using {} 12,79
[83, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y6171'], ['rr', 'a']] using {'r': 'a'} 6,48
[84, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y1824'], ['coyote', 'y6171']] using {} 12,48
[85, [], ['catch', 'b', 'a'], ['coyote', 'y6841'], ['rr', 'a']] using {'y': 'b'} 7,49
[86, [], ['catch', 'b', 'a'], ['coyote', 'y6841']] using {} 9,85
[87, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y6841']] using {} 1,85
[88, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y3711'], ['coyote', 'y6841']] using {} 1,49
[89, [], ['catch', 'b', 'a'], ['coyote', 'y4747'], ['coyote', 'y7442']] using {'y': 'b'} 7,50
[90, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y7442']] using {'y4747': 'b'} 7,50
[91, [], ['catch', 'b', 'a'], ['coyote', 'y7442']] using {'y4747': 'b'} 7,89
[92, [], ['catch', 'b', 'a'], ['coyote', 'y4404'], ['coyote', 'y549']] using {'y': 'b'} 7,51
[93, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y4404']] using {'y549': 'b'} 7,51
[94, [], ['catch', 'b', 'a'], ['coyote', 'y4404']] using {'y549': 'b'} 7,92
[95, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y3101']] using {} 12,63
[96, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y2185']] using {} 1,64
[97, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y9042']] using {} 16,67
[98, [], ['beep', 'a'], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y3521']] using {} 17,67
[99, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y9491'], ['rr', 'a']] using {} 19,67
[100, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y214'], ['coyote', 'y4747']] using {} 20,67
[101, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y'], ['coyote', 'y4717'], ['coyote', 'y549']] using {} 21,67
[102, [], ['beep', 'a'], ['catch', 'b', 'a'], ['coyote', 'y133']] using {'y': 'b'} 7,75
[103, [], ['catch', 'b', 'a'], ['coyote', 'y133']] using {} 11,102
[104, [], ['catch', 'b', 'a'], ['coyote', 'y133'], ['rr', 'a']] using {'r': 'a'} 6,102
[105, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y133']] using {} 12,102
[106, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y133'], ['rr', 'a']] using {'r': 'a'} 6,75
[107, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y133'], ['coyote', 'y6828']] using {} 12,75
[108, [], ['catch', 'b', 'a'], ['coyote', 'y4825'], ['rr', 'a']] using {'y': 'b'} 7,76
[109, [], ['catch', 'b', 'a'], ['coyote', 'y4825']] using {} 9,108
[110, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y4825']] using {} 1,108
[111, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y4825'], ['coyote', 'y9302']] using {} 1,76
[112, [], ['catch', 'b', 'a'], ['coyote', 'y4747'], ['coyote', 'y8018']] using {'y': 'b'} 7,77
[113, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y8018']] using {'y4747': 'b'} 7,77
[114, [], ['catch', 'b', 'a'], ['coyote', 'y8018']] using {'y4747': 'b'} 7,112
[115, [], ['catch', 'b', 'a'], ['coyote', 'y2267'], ['coyote', 'y549']] using {'y': 'b'} 7,78
[116, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y2267']] using {'y549': 'b'} 7,78
[117, [], ['catch', 'b', 'a'], ['coyote', 'y2267']] using {'y549': 'b'} 7,115
[118, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y6171'], ['coyote', 'y991']] using {} 1,83
[119, [], ['catch', 'b', 'a'], ['coyote', 'y1824'], ['coyote', 'y6171']] using {'y': 'b'} 7,84
[120, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y1824']] using {'y6171': 'b'} 7,84
[121, [], ['catch', 'b', 'a'], ['coyote', 'y1824']] using {'y6171': 'b'} 7,119
[122, [], ['catch', 'b', 'a'], ['coyote', 'y3711'], ['coyote', 'y6841']] using {'y': 'b'} 7,88
[123, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y3711']] using {'y6841': 'b'} 7,88
[124, [], ['catch', 'b', 'a'], ['coyote', 'y3711']] using {'y6841': 'b'} 7,122
[125, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y3101']] using {'w': 'b'} 7,95
[126, [], ['catch', 'w', 'a'], ['coyote', 'w'], ['coyote', 'y3101']] using {'y': 'b'} 7,95
[127, [], ['catch', 'b', 'a'], ['coyote', 'y3101']] using {'y': 'b'} 7,125
[128, [], ['catch', 'b', 'a'], ['coyote', 'y'], ['coyote', 'y2185']] using {'w': 'b'} 7,96

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[129, [], [['catch', 'w', ['a']], ['coyote', 'w'], ['coyote', 'y2185']]] using {'y': ['b']} 7,96
[130, [], [['catch', ['b'], ['a']], ['coyote', 'y2185']]] using {'y': ['b']} 7,128
[131, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y9042']]] using {'w': ['b']} 7,97
[132, [], [['catch', 'w', ['a']], ['coyote', 'w'], ['coyote', 'y9042']]] using {'y': ['b']} 7,97
[133, [], [['catch', ['b'], ['a']], ['coyote', 'y9042']]] using {'y': ['b']} 7,131
[134, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y133'], ['coyote', 'y8879']]] using {} 1,106
[135, [], [['catch', ['b'], ['a']], ['coyote', 'y133'], ['coyote', 'y6828']]] using {'y': ['b']} 7,107
[136, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y6828']]] using {'y133': ['b']} 7,107
[137, [], [['catch', ['b'], ['a']], ['coyote', 'y6828']]] using {'y133': ['b']} 7,135
[138, [], [['catch', ['b'], ['a']], ['coyote', 'y4825'], ['coyote', 'y9302']]] using {'y': ['b']} 7,111
[139, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y9302']]] using {'y4825': ['b']} 7,111
[140, [], [['catch', ['b'], ['a']], ['coyote', 'y9302']]] using {'y4825': ['b']} 7,138
[141, [], [['catch', ['b'], ['a']], ['coyote', 'y6171'], ['coyote', 'y991']]] using {'y': ['b']} 7,118
[142, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y991']]] using {'y6171': ['b']} 7,118
[143, [], [['catch', ['b'], ['a']], ['coyote', 'y991']]] using {'y6171': ['b']} 7,141
[144, [], [['catch', ['b'], ['a']], ['coyote', 'y133'], ['coyote', 'y8879']]] using {'y': ['b']} 7,134
[145, [], [['catch', ['b'], ['a']], ['coyote', 'y'], ['coyote', 'y8879']]] using {'y133': ['b']} 7,134
[146, [], [['catch', ['b'], ['a']], ['coyote', 'y8879']]] using {'y133': ['b']} 7,144
[147, [['catch', ['b'], 't'], ['frustrated', ['b']], ['chase', ['b'], 't'], ['rr', 't']]] using {'s': ['b']} 7,5
[148, [['catch', ['b'], 't'], ['chase', ['b'], 't'], ['rr', 't']]] using {} 147,8
[149, [['catch', ['b'], ['a']], ['chase', ['b'], ['a']]] using {'t': ['a']} 9,148
[150, [['catch', ['b'], ['a']], []]] using {} 10,149
FINAL RES: 150,26('NUMBER OF STEPS:', 150)

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UNIT PREFERENCE RESOLUTION STEPS FOR Harmonia

```

[1, [['grandparent', 'x', 'y']], [['parent', 'x', 'z'], ['parent', 'z', 'y']]]
[2, [['parent', 'x', 'y']], [['mother', 'x', 'y']]]
[3, [['parent', 'x', 'y']], [['father', 'x', 'y']]]
[4, [['father', ['Zeus'], ['Ares']]], []]
[5, [['mother', ['Hera'], ['Ares']]], []]
[6, [['father', ['Ares'], ['Harmonia']]], []]
[7, [], [['grandparent', 'x', ['Harmonia']]]]
[8, [['parent', ['Hera'], ['Ares']]], []] using {'y': ['Ares'], 'x': ['Hera']} 5,2
[9, [['parent', ['Zeus'], ['Ares']]], []] using {'y': ['Ares'], 'x': ['Zeus']} 4,3
[10, [['parent', ['Ares'], ['Harmonia']]], []] using {'y': ['Harmonia'], 'x': ['Ares']} 6,3
[11, [], [['parent', 'x', 'z'], ['parent', 'z', ['Harmonia']]]] using {'y': ['Harmonia']} 1,7
[12, [], [['parent', ['Ares'], ['Harmonia']]]] using {'x': ['Hera'], 'z': ['Ares']} 8,11
FINAL RES: 10,12('NUMBER OF STEPS:', 12)

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UNIT PREFERENCE RESOLUTION STEPS FOR Test

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[1, [['P', 'x', ['BETA']], ['Q', 'x'], ['S', 'y', 'res']], []]
[2, [['R', 'x'], ['T', 'x']], [['P', 'x', 'w']]]
[3, [['R', 'x']], [['Q', 'x']]]
[4, [['S', 'y', ['ZETA']], ['R', 'x']]]
[5, [], [['S', 'y', ['ZETA']]]]
[6, [], [['T', 'x']]]
[7, [], [['R', 'x']]] using {} 4,5
[8, [], [['Q', 'x']]] using {} 3,7
[9, [['S', 'y', ['ZETA']]], [['Q', 'x1524']]] using {'x': 'x1524'} 3,4
[10, [], [['Q', 'x1524']]] using {} 9,5
[11, [['P', 'x', ['BETA']], ['Q', 'x']], []] using {'res': ['ZETA']} 1,5
[12, [['P', 'x', ['BETA']]], []] using {} 11,8
[13, [['P', 'x1524', ['BETA']]], []] using {'x': 'x1524'} 11,10
[14, [['P', 'x', ['BETA']], ['R', 'x']], []] using {'x385': 'x'} 11,3
[15, [['P', 'x1524', ['BETA']], ['S', 'y', ['ZETA']]], []] using {'x': 'x1524'} 11,9
[16, [['P', 'x', ['BETA']], ['S', 'y', ['ZETA']]], []] using {'x177': 'x'} 14,4
[17, [['P', 'x', ['BETA']], ['S', 'y', 'res']], []] using {} 1,8
[18, [['P', 'x1524', ['BETA']], ['S', 'y', 'res']], []] using {'x': 'x1524'} 1,10
[19, [['P', 'x', ['BETA']], ['R', 'x'], ['S', 'y', 'res']], []] using {'x7381': 'x'} 1,3
[20, [['P', 'x1524', ['BETA']], ['S', 'y', ['ZETA']], ['S', 'y', 'res']], []] using {'x': 'x1524'} 1,9
[21, [['R', 'x']], [['P', 'x', 'w']]] using {} 2,6
[22, [], [['P', 'x', 'w']]] using {} 21,7

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FINAL RES: 12,22('NUMBER OF STEPS:', 22)

QUESTION ANSWERING STEPS FOR Harmonia USING TWO POINTER

```
[1, [['grandparent', 'x', 'y']], [['parent', 'x', 'z'], ['parent', 'z', 'y']]]
[2, [['parent', 'x', 'y']], [['mother', 'x', 'y']]]
[3, [['parent', 'x', 'y']], [['father', 'x', 'y']]]
[4, [['father', 'Zeus'], ['Ares']], []]
[5, [['mother', 'Hera'], ['Ares']], []]
[6, [['father', 'Ares'], ['Harmonia']], []]
[7, [], [['grandparent', 'x', 'Harmonia']]]]
[8, [['answer', 'x7923']], [['parent', 'x7923', 'z'], ['parent', 'z', 'Harmonia']]] using {'y': ['Harmonia'], 'x': 'x7923'} 1,7
[9, [['answer', 'x7923']], [['mother', 'x7923', 'y'], ['parent', 'y', 'Harmonia']]] using {'x': 'x7923', 'z': 'y'} 2,8
[10, [['answer', 'x7923']], [['mother', 'z', 'Harmonia']], ['parent', 'x7923', 'z']]] using {'y': ['Harmonia'], 'x': 'z'} 2,8
[11, [['answer', 'x7923']], [['father', 'x7923', 'y'], ['parent', 'y', 'Harmonia']]] using {'x': 'x7923', 'z': 'y'} 3,8
[12, [['answer', 'x7923']], [['father', 'z', 'Harmonia']], ['parent', 'x7923', 'z']]] using {'y': ['Harmonia'], 'x': 'z'} 3,8
[13, [['answer', 'x7923']], [['mother', 'x7923', 'y4211'], ['mother', 'y4211', 'Harmonia']]] using {'y': ['Harmonia'], 'x': 'y4211'} 2,9
[14, [['answer', 'x7923']], [['father', 'y8475', 'Harmonia']], ['mother', 'x7923', 'y8475']]] using {'y': ['Harmonia'], 'x': 'y8475'} 3,9
[15, [['answer', 'Hera']], [['parent', 'Ares'], ['Harmonia']]] using {'y': ['Ares'], 'x7923': ['Hera']} 5,9
[16, [['answer', 'x7923']], [['mother', 'x7923', 'y'], ['mother', 'y', 'Harmonia']]] using {'x': 'x7923', 'z': 'y'} 2,10
[17, [['answer', 'x7923']], [['father', 'x7923', 'y'], ['mother', 'y', 'Harmonia']]] using {'x': 'x7923', 'z': 'y'} 3,10
[18, [['answer', 'x7923']], [['father', 'x7923', 'y4409'], ['mother', 'y4409', 'Harmonia']]] using {'y': ['Harmonia'], 'x': 'y4409'} 2,11
[19, [['answer', 'x7923']], [['father', 'x7923', 'y7043'], ['father', 'y7043', 'Harmonia']]] using {'y': ['Harmonia'], 'x': 'y7043'} 3,11
[20, [['answer', 'Zeus']], [['parent', 'Ares'], ['Harmonia']]] using {'y': ['Ares'], 'x7923': ['Zeus']} 4,11
[21, [['answer', 'Ares']], [['parent', 'Harmonia'], ['Harmonia']]] using {'y': ['Harmonia'], 'x7923': ['Ares']} 6,11
[22, [['answer', 'x7923']], [['father', 'y', 'Harmonia']], ['mother', 'x7923', 'y']]] using {'x': 'x7923', 'z': 'y'} 2,12
[23, [['answer', 'x7923']], [['father', 'x7923', 'y'], ['father', 'y', 'Harmonia']]] using {'x': 'x7923', 'z': 'y'} 3,12
[24, [['answer', 'x7923']], [['parent', 'x7923', 'Ares']]] using {'z': ['Ares']} 6,12
[25, [['answer', 'Hera']], [['mother', 'Ares'], ['Harmonia']]] using {'y4211': ['Ares'], 'x7923': ['Hera']} 5,13
[26, [['answer', 'Hera']], [['father', 'Ares'], ['Harmonia']]] using {'y8475': ['Ares'], 'x7923': ['Hera']} 5,14
[27, [['answer', 'x7923']], [['mother', 'x7923', 'Ares']]] using {'y8475': ['Ares']} 6,14
[28, [['answer', 'Zeus']], [['mother', 'Ares'], ['Harmonia']]] using {'y': ['Ares'], 'x7923': ['Zeus']} 4,17
[29, [['answer', 'Ares']], [['mother', 'Harmonia'], ['Harmonia']]] using {'y': ['Harmonia'], 'x7923': ['Ares']} 6,17
[30, [['answer', 'Zeus']], [['father', 'Ares'], ['Harmonia']]] using {'x7923': ['Zeus'], 'y7043': ['Ares']} 4,19
[31, [['answer', 'Ares']], [['father', 'Harmonia'], ['Harmonia']]] using {'x7923': ['Ares'], 'y7043': ['Harmonia']} 6,19
[32, [['answer', 'x7923']], [['father', 'x7923', 'Ares']]] using {'y7043': ['Ares']} 6,19
FINAL RES: 6,26('NUMBER OF STEPS:', 32)
The answer is Hera
```

QUESTION ANSWERING STEPS FOR Harmonia USING Unit Preference

```
[1, [['grandparent', 'x', 'y']], [['parent', 'x', 'z'], ['parent', 'z', 'y']]]
[2, [['parent', 'x', 'y']], [['mother', 'x', 'y']]]
[3, [['parent', 'x', 'y']], [['father', 'x', 'y']]]
[4, [['father', 'Zeus'], ['Ares']], []]
[5, [['mother', 'Hera'], ['Ares']], []]
[6, [['father', 'Ares'], ['Harmonia']], []]
[7, [['answer', 'x']], [['grandparent', 'x', 'Harmonia']]]]
[8, [['parent', 'Hera'], ['Ares']], []] using {'y': ['Ares'], 'x': ['Hera']} 5,2
[9, [['parent', 'Zeus'], ['Ares']], []] using {'y': ['Ares'], 'x': ['Zeus']} 4,3
[10, [['parent', 'Ares'], ['Harmonia']], []] using {'y': ['Harmonia'], 'x': ['Ares']} 6,3
[11, [['grandparent', 'Hera', 'y']], [['parent', 'Ares', 'y']]] using {'x': ['Hera'], 'z': ['Ares']} 8,1
[12, [['grandparent', 'x', 'Ares']], [['parent', 'x', 'Hera']]] using {'y': ['Ares'], 'z': ['Hera']} 8,1
[13, [['grandparent', 'Hera'], ['Harmonia']], []] using {'y': ['Harmonia']} 10,11
FINAL RES: 13,7('NUMBER OF STEPS:', 13)
The answer is Hera
```