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EECS 118 Geometry Solver Testing Report

For the Geometry Solver term project, we were required to implement solver programs for the two geometry problems assigned to our team. Various predicate sequences containing one to three inputs were tested against the implemented solvers. The input test cases and the output results were recorded for each problem respectively in the tables below. We tested sequences with one to three of the same input predicate to ensure that each predicate produced the correct results. We then tested cases combining different predicates. Cases with four input predicates were also used to test the functionality of inputs greater than three predicates.

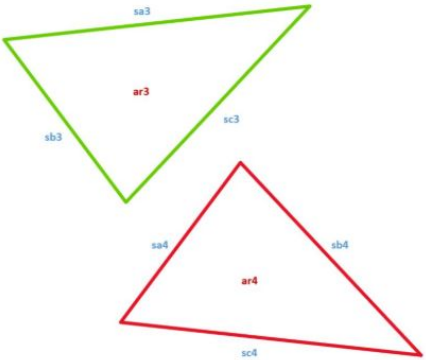
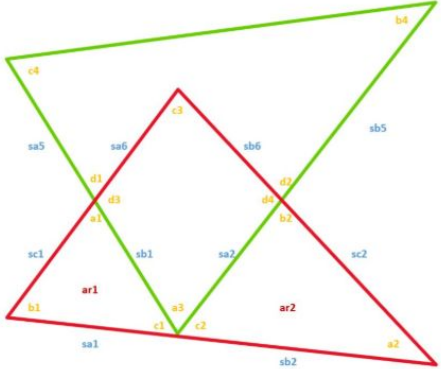
The solver programs for both assigned problems were testing using a web page UI using cgi. This allowed us to quickly input the correct names for each part of the diagram when conducting testing. The resulting dictionary of the solver was printed to the output section of the web page, which was copied and pasted into the tables below for each test case.

Problem 1
Problem 2

Two triangles have three intersection points

Three intersections are on three different sides of a triangle
 No side of a triangle is completely inside another triangle

Diagrams

Inputs

Get All

Output

```
{ 'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2']], 'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd4', 180], ['c3', 'd3', 180]], 'parallel': [['sa5', 'sb6'], ['sa5', 'sb4'], ['sa5', 'sc2'], ['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6']], 'similar': [['ar1', 'ar4']] }
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Figure 1: Web-based CGI interface for solver testing

Problem 1

Three intersections are on three different sides of a triangle
 No side of a triangle is completely inside another triangle

Input	Output
set_equal('d1','d2')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['d1', 'd2'], ['d2', 'a1'], ['a1', 'b2'], ['b2', 'd1'], ['d3', 'd4']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['d1', 'd4', 180], ['d4', 'a1', 180], ['d2', 'd3', 180], ['b2', 'd3', 180]]}
set_equal('sa4','sc4')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['sa4', 'sc4'], ['a2', 'c3']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['sa6', 'sc1', 'sc4'], ['sa1', 'sb2', 'sa4']]}
set_equal('d1','d2') set_equal('sa4','sb4')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['d1', 'd2'], ['d2', 'a1'], ['a1', 'b2'], ['b2', 'd1'], ['d3', 'd4'], ['sa4', 'sb4'], ['a2', 'b1'], ['c1', 'c2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['d1', 'd4', 180], ['d4', 'a1', 180], ['d2', 'd3', 180], ['b2', 'd3', 180], ['sa6', 'sc1', 'sb4'], ['sb6', 'sc2', 'sa4']], 'similar' : [['ar1', 'ar2']]}
set_equal('sb3','sb4') set_equal('sc3','sa4') set_equal('a3','c3')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['sb3', 'sb4'], ['sc3', 'sa4'], ['a3', 'c3'], ['a2', 'c4'], ['sc4', 'sa3'], ['b1', 'b4']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['sa5', 'sb1', 'sb4'], ['sb6', 'sc2', 'sb3'], ['sb5', 'sa2', 'sa4'], ['sa6', 'sc1', 'sc3'], ['sa1', 'sb2', 'sa3']], 'congruent' : [['ar4', 'ar3']]}
set_sum_value('d3','a3',90)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['d3', 'a3', 90], ['c3', 'd4', 270]], 'perpendicular' : [['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa6', 'sc3'], ['sa6', 'sb5'], ['sa6', 'sa2'], ['sc1', 'sc3'], ['sc1', 'sb5'], ['sc1', 'sa2']]}
set_sum_value('sb2','sa1',6)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['sb2', 'sa1', 6]]}
set_sum_value('a1','c1',90) set_sum_value('a2','b2',90)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['b1', 'c2'], ['a3', 'd1'], ['a3', 'a1'], ['c3', 'd2'], ['c3', 'b2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a1', 'c1', 90], ['a2', 'c3', 90], ['d1', 'c1', 90], ['a2', 'c3', 'b1'], ['a1', 'c1', 'b1'], ['a2', 'b2', 90], ['a1', 'c1', 'c2'], ['a2', 'c3', 'c2'], ['c1', 'a3', 90], ['a2', 'd2', 90], ['c1', 'a3', 'c2'], ['c1', 'a3', 'b1'], ['a2', 'b2', 'c2'], ['a2', 'b2', 'b1'], ['a3', 'd3', 180], ['c3', 'd4', 180], ['d2', 'a2', 'b1'], ['d2', 'a2', 'c2'], ['d1', 'c1', 'c2'], ['d1', 'c1', 'b1']], 'perpendicular' : [['sa4', 'sc4'], ['sa4', 'sa1'], ['sa4', 'sb2'], ['sa6', 'sc4'], ['sa6', 'sa1'], ['sa6', 'sb2'], ['sc1', 'sc4'], ['sc1', 'sa1'], ['sc1', 'sb2'], ['sc3', 'sc4'], ['sc3', 'sa1'],

	<p>['sc3', 'sb2'], ['sb5', 'sc4'], ['sb5', 'sa1'], ['sb5', 'sb2'], ['sa2', 'sc4'], ['sa2', 'sa1'], ['sa2', 'sb2']],</p> <p>'parallel': [['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa2', 'sa6'], ['sa2', 'sc1'], ['sc1', 'sc3'], ['sc1', 'sb5'], ['sb5', 'sa6'], ['sa6', 'sc3']],</p> <p>'similar': [['ar4', 'ar2']]]}</p>
<p>set_sum_value('b1','c3',120)</p> <p>set_sum_value('a2','c3',120)</p> <p>set_sum_value('d3','d4',90)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a2', 'b1'], ['sa4', 'sb4'], ['b1', 'c3'], ['c3', 'a2'], ['sa4', 'sc4'], ['sc4', 'sb4']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b1', 'c3', 120], ['a2', 'c3', 120], ['a2', 'b1', 120], ['sa6', 'sc1', 'sb4'], ['sb6', 'sc2', 'sa4'], ['sa6', 'sc1', 'sc4'], ['sa1', 'sb2', 'sa4'], ['sa1', 'sb2', 'sb4'], ['sb6', 'sc2', 'sc4'], ['d3', 'd4', 90], ['c3', 'a3', 270], ['b1', 'a3', 270], ['a2', 'a3', 270]]}</p>
<p>set_fraction('d1','d3',3)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']],</p> <p>'fraction': [['d1', 'd3', 3], ['a1', 'd3', 3]]}</p>
<p>set_fraction('sa2','sb5',4)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']],</p> <p>'fraction': [['sa2', 'sb5', 4], ['sc3', 'sb5', 5], ['sc3', 'sa2', 1.25]]}</p>
<p>set_fraction('d1','d3',3)</p> <p>set_fraction('d2','d1',2)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']],</p> <p>'fraction': [['d1', 'd3', 3], ['a1', 'd3', 3], ['d2', 'd1', 2], ['d2', 'a1', 2], ['b2', 'a1', 2], ['b2', 'd1', 2], ['b2', 'd3', 6], ['d2', 'd3', 6]]}</p>
<p>set_fraction('d1','d3',3)</p> <p>set_fraction('d1','d2',2)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']],</p> <p>'fraction': [['d1', 'd3', 3], ['a1', 'd3', 3], ['d1', 'd2', 2], ['d1', 'b2', 2], ['a1', 'b2', 2], ['a1', 'd2', 2], ['d2', 'd3', 1.5], ['b2', 'd3', 1.5]]}</p>
<p>set_fraction('d1','d3',3)</p> <p>set_fraction('d2','d1',2)</p> <p>set_fraction('d4','d2',3)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']],</p> <p>'fraction': [['d1', 'd3', 3], ['a1', 'd3', 3], ['d2', 'd1', 2], ['d2', 'a1', 2], ['b2', 'a1', 2], ['b2', 'd1', 2], ['b2', 'd3', 6], ['d2', 'd3', 6], ['d4', 'd2', 3], ['d4', 'b2', 3], ['d4', 'a1', 6], ['d4', 'd1', 6], ['d4', 'd3', 18]]}</p>
<p>set_parallel('sa5', 'sb6')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd4', 180], ['c3', 'd3', 180]],</p>

	<p>'parallel': [['sa5', 'sb6'], ['sa5', 'sb4'], ['sa5', 'sc2'], ['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6']],</p> <p>'similar': [['ar1', 'ar4']]</p>
<p>set_parallel('sb3', 'sb4')</p> <p>set_parallel('sc3', 'sa4')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['c3', 'd1'], ['c3', 'a1'], ['c1', 'a2'], ['a3', 'd1'], ['d1', 'd2'], ['d2', 'a1'], ['a1', 'b2'], ['b2', 'd1'], ['b2', 'c3'], ['c3', 'd2'], ['c3', 'a3'], ['a3', 'a1'], ['b1', 'c2'], ['d3', 'd4']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd4', 180], ['c3', 'd3', 180], ['a1', 'd4', 180], ['a3', 'd3', 180], ['d2', 'd3', 180], ['d1', 'd4', 180], ['b2', 'd3', 180], ['c3', 'd4', 180]],</p> <p>'parallel': [['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4'], ['sc3', 'sa4'], ['sc3', 'sa6'], ['sc3', 'sc1'], ['sc1', 'sb5'], ['sc1', 'sa2'], ['sa2', 'sa4'], ['sa2', 'sa6'], ['sa6', 'sb5'], ['sb5', 'sa4']],</p> <p>'similar': [['ar1', 'ar4'], ['ar1', 'ar2'], ['ar4', 'ar2']]</p>
<p>set_parallel('sb1', 'sc2')</p> <p>set_parallel('sc3', 'sa4')</p> <p>set_parallel('sa3', 'sa1')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2'], ['a3', 'd1'], ['d1', 'd2'], ['d2', 'a1'], ['a1', 'b2'], ['b2', 'd1'], ['b2', 'c3'], ['c3', 'd2'], ['c3', 'a3'], ['a3', 'a1'], ['b1', 'c2'], ['d3', 'd4'], ['c1', 'c4'], ['c4', 'a2'], ['b1', 'b4'], ['b4', 'c2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd4', 180], ['c3', 'd3', 180], ['a1', 'd4', 180], ['a3', 'd3', 180], ['d2', 'd3', 180], ['d1', 'd4', 180], ['b2', 'd3', 180], ['c3', 'd4', 180]],</p> <p>'parallel': [['sb1', 'sc2'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sa5', 'sb4'], ['sa5', 'sb6'], ['sc3', 'sa4'], ['sc3', 'sa6'], ['sc3', 'sc1'], ['sc1', 'sb5'], ['sc1', 'sa2'], ['sa2', 'sa4'], ['sa2', 'sa6'], ['sa6', 'sb5'], ['sb5', 'sa4'], ['sa3', 'sa1'], ['sa3', 'sc4'], ['sa3', 'sb2']],</p> <p>'similar': [['ar1', 'ar4'], ['ar1', 'ar2'], ['ar4', 'ar2'], ['ar1', 'ar3'], ['ar4', 'ar3'], ['ar2', 'ar3']]</p>
<p>set_perpendicular('sb3', 'sa1')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b1', 'a1', 90], ['d1', 'b1', 90], ['c2', 'a3', 90], ['c2', 'a3', 'c1'], ['a1', 'b1', 'c1'], ['b1', 'd1', 'c1']],</p> <p>'perpendicular': [['sb3', 'sa1'], ['sb3', 'sc4'], ['sb3', 'sb2'], ['sa5', 'sc4'], ['sa5', 'sa1'], ['sa5', 'sb2'], ['sb1', 'sc4'], ['sb1', 'sa1'], ['sb1', 'sb2']]</p>
<p>set_perpendicular('sb1', 'sb5')</p> <p>set_perpendicular('sa2', 'sb4')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'b2'], ['a3', 'd2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2'], ['b2', 'd4'], ['d4', 'd2'], ['d4', 'a3']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b4', 'c4', 90], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['b4', 'c4', 'a3'], ['a3', 'd4', 180], ['c1', 'c2', 'b2'], ['c1', 'c2', 'd2'], ['c3', 'd3', 180], ['a2', 'c2', 90], ['a2', 'c2', 'a3'], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['b4', 'c4', 'b2'], ['b4', 'c4', 'd2'], ['a3', 'd2', 180], ['c1', 'c2', 'd4'], ['a3', 'b2', 180], ['b2', 'd2', 180], ['a2', 'c2', 'd4'], ['b4', 'c4', 'd4']],</p> <p>'perpendicular': [['sb1', 'sb5'], ['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sa2'], ['sa2', 'sb4'], ['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb6'], ['sa2', 'sc2']],</p> <p>'parallel': [['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sc2', 'sb1'], ['sb1',</p>

	'sb4'], ['sb1', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4']], 'similar': [['ar1', 'ar4']]}
set_perpendicular('sb1', 'sb5') set_perpendicular('sa2', 'sb4') set_perpendicular('sa4', 'sb4')	{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'b2'], ['a3', 'd2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2'], ['b2', 'd4'], ['d4', 'd2'], ['d4', 'a3'], ['b2', 'a1'], ['a1', 'd2'], ['d2', 'd1'], ['d1', 'b2'], ['b2', 'c3'], ['c3', 'd2'], ['c3', 'a3'], ['a3', 'a1'], ['a1', 'd4'], ['d4', 'd1'], ['d1', 'a3'], ['a1', 'd3'], ['d3', 'd1'], ['d3', 'c3'], ['d3', 'b2'], ['d3', 'd2'], ['d3', 'a3'], ['d3', 'd4'], ['d4', 'c3'], ['b1', 'c2']], 'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b4', 'c4', 90], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['b4', 'c4', 'a3'], ['a3', 'd4', 180], ['c1', 'c2', 'b2'], ['c1', 'c2', 'd2'], ['c3', 'd3', 180], ['a2', 'c2', 90], ['a2', 'c2', 'a3'], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['b4', 'c4', 'b2'], ['b4', 'c4', 'd2'], ['a3', 'd2', 180], ['c1', 'c2', 'd4'], ['a3', 'b2', 180], ['b2', 'd2', 180], ['a2', 'c2', 'd4'], ['b4', 'c4', 'd4'], ['a3', 'd3', 180], ['c1', 'c2', 'c3'], ['c3', 'd2', 180], ['a2', 'b1', 90], ['b1', 'c1', 90], ['a2', 'b1', 'c3'], ['b4', 'c4', 'c3'], ['c1', 'c2', 'a1'], ['c1', 'c2', 'd1'], ['c1', 'c2', 'd3'], ['b4', 'c4', 'a1'], ['b4', 'c4', 'd1'], ['b4', 'c4', 'd3'], ['b1', 'c1', 'a1'], ['b1', 'c1', 'd1'], ['b1', 'c1', 'c3'], ['b1', 'c1', 'b2'], ['b1', 'c1', 'd2'], ['b1', 'c1', 'a3'], ['b1', 'c1', 'd4'], ['b1', 'c1', 'd3'], ['a2', 'b1', 'a1'], ['a2', 'b1', 'd1'], ['a2', 'b1', 'b2'], ['a2', 'b1', 'd2'], ['a2', 'b1', 'a3'], ['a2', 'b1', 'd3'], ['a2', 'b1', 'd4'], ['a2', 'c2', 'a1'], ['a2', 'c2', 'd1'], ['a2', 'c2', 'c3'], ['a2', 'c2', 'd3'], ['c3', 'a1', 180], ['c3', 'd1', 180], ['c3', 'b2', 180], ['c3', 'a3', 180], ['c3', 'd4', 180], ['a1', 'd1', 180], ['d1', 'b2', 180], ['d1', 'd2', 180], ['d1', 'a3', 180], ['d1', 'd4', 180], ['a1', 'b2', 180], ['a1', 'd2', 180], ['a1', 'a3', 180], ['a1', 'd4', 180], ['d2', 'd3', 180], ['b2', 'd3', 180], ['d4', 'd3', 180]], 'perpendicular': [['sb1', 'sb5'], ['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sa2'], ['sa2', 'sb4'], ['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb6'], ['sa2', 'sc2'], ['sa4', 'sb4'], ['sa4', 'sb6'], ['sa4', 'sc2'], ['sa6', 'sb4'], ['sa6', 'sb6'], ['sa6', 'sc2'], ['sc1', 'sb4'], ['sc1', 'sb6'], ['sc1', 'sc2'], ['sb3', 'sa4'], ['sb3', 'sa6'], ['sb3', 'sc1'], ['sa5', 'sa4'], ['sa5', 'sa6'], ['sa5', 'sc1'], ['sb1', 'sa4'], ['sb1', 'sa6'], ['sb1', 'sc1']], 'parallel': [['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4'], ['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa2', 'sa6'], ['sa2', 'sc1'], ['sc1', 'sc3'], ['sc1', 'sb5'], ['sb5', 'sa6'], ['sa6', 'sc3']], 'similar': [['ar1', 'ar4'], ['ar1', 'ar2'], ['ar4', 'ar2']]}
set_perpendicular('sb1', 'sa2') set_parallel('sb1', 'sb6')	{'equal': [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['a3', 'd4'], ['d4', 'd2'], ['d4', 'b2'], ['a1', 'c3'], ['c3', 'd1'], ['c1', 'a2']], 'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b4', 'c4', 90], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['b4', 'c4', 'a3'], ['a3', 'd4', 180], ['c1', 'c2', 'd2'], ['d2', 'a3', 180], ['d2', 'b2', 180], ['b2', 'a3', 180], ['a2', 'c2', 90], ['b4', 'c4', 'd2'], ['c1', 'c2', 'b2'], ['c1', 'c2', 'd4'], ['b4', 'c4', 'b2'], ['b4', 'c4', 'd4'], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['a2', 'c2', 'a3'], ['a2', 'c2', 'd4'], ['c3', 'd3', 180]], 'perpendicular': [['sb1', 'sa2'], ['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sb5'], ['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb4'], ['sa2', 'sb6'], ['sa2', 'sc2']], 'parallel': [['sb1', 'sb6'], ['sb1', 'sb4'], ['sb1', 'sc2'], ['sc2', 'sb3'], ['sc2', 'sa5'], ['sb3',

	'sb4'], ['sb3', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4']], 'similar' : [['ar1', 'ar4']]]}
set_equal('sb2', 'sc2') set_sum_value('b2', 'c2', 90)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['sb2', 'sc2'], ['b2', 'c2'], ['c2', 'd2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['sc2', 'sa1', 'sc4'], ['c2', 'd4', 180], ['sb2', 'sb6', 'sb4'], ['b2', 'c2', 90], ['b1', 'c3', 90], ['b2', 'd2', 90], ['b1', 'c3', 'a2'], ['d2', 'c2', 90], ['b2', 'c2', 'a2']], 'perpendicular' : [['sb4', 'sc4'], ['sb4', 'sa1'], ['sb4', 'sb2'], ['sb6', 'sc4'], ['sb6', 'sa1'], ['sb6', 'sb2'], ['sc2', 'sc4'], ['sc2', 'sa1'], ['sc2', 'sb2']]]}
set_parallel('sa3', 'sc4') set_fraction('c1', 'a1', 3)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['c1', 'c4'], ['b4', 'c2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']], 'parallel' : [['sa3', 'sc4'], ['sa3', 'sa1'], ['sa3', 'sb2']], 'fraction' : [['c1', 'a1', 3], ['c1', 'd1', 3], ['c4', 'd1', 3], ['c4', 'a1', 3]]}
set_perpendicular('sa6', 'sb6') set_equal('a3', 'c3')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['a3', 'c3']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a2', 'b1', 90], ['a2', 'b1', 'c3'], ['a3', 'c3', 180], ['b4', 'c4', 90], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['c1', 'c2', 'c3'], ['b4', 'c4', 'a3'], ['b4', 'c4', 'c3'], ['d3', 'd4', 180]], 'perpendicular' : [['sa6', 'sb6'], ['sa4', 'sb4'], ['sa4', 'sb6'], ['sa4', 'sc2'], ['sa6', 'sb4'], ['sa6', 'sc2'], ['sc1', 'sb4'], ['sc1', 'sb6'], ['sc1', 'sc2'], ['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sb5'], ['sb1', 'sa2']]]}
set_fraction('sb1', 'sa2', 2) set_equal('sa5', 'sb1')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['sa5', 'sb1']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4']], 'fraction' : [['sb1', 'sa2', 2], ['sa5', 'sa2', 2], ['sb3', 'sa2', 4], ['sb3', 'sb1', 2.0], ['sb3', 'sa5', 2.0]]}
set_sum_value('a3', 'd3', 90) set_equal('c3', 'd1') set_fraction('d1', 'd3', 3)	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['c3', 'd1'], ['c3', 'a1'], ['a3', 'd2'], ['a3', 'b2'], ['c1', 'a2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd3', 90], ['c3', 'd4', 270], ['a1', 'd4', 270], ['b2', 'd3', 90], ['a3', 'd4', 180], ['d1', 'd4', 270], ['c3', 'd3', 180], ['d2', 'd3', 90]], 'perpendicular' : [['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa6', 'sc3'], ['sa6', 'sb5'], ['sa6', 'sa2'], ['sc1', 'sc3'], ['sc1', 'sb5'], ['sc1', 'sa2']], 'parallel' : [['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4']], 'similar' : [['ar1', 'ar4']], 'fraction' : [['d1', 'd3', 3], ['a1', 'd3', 3], ['c3', 'd3', 3]]}
set_parallel('sb3', 'sc2') set_parallel('sc1', 'sb5') set_equal('c2', 'b4')	{ 'equal' : [['d1', 'a1'], ['d2', 'b2'], ['a3', 'd2'], ['a3', 'b2'], ['c3', 'd1'], ['c3', 'a1'], ['c1', 'a2'], ['a3', 'd1'], ['d1', 'd2'], ['d2', 'a1'], ['a1', 'b2'], ['b2', 'd1'], ['b2', 'c3'], ['c3', 'd2'], ['c3', 'a3'], ['a3', 'a1'], ['b1', 'c2'], ['d3', 'd4'], ['c2', 'b4'], ['b4', 'b1'], ['c1', 'c4'], ['c4', 'a2']],

	<p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a3', 'd4', 180], ['c3', 'd3', 180], ['a1', 'd4', 180], ['a3', 'd3', 180], ['d2', 'd3', 180], ['d1', 'd4', 180], ['b2', 'd3', 180], ['c3', 'd4', 180]],</p> <p>'parallel': [['sb3', 'sc2'], ['sb3', 'sb4'], ['sb3', 'sb6'], ['sb6', 'sa5'], ['sb6', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sc2'], ['sc2', 'sa5'], ['sa5', 'sb4'], ['sc1', 'sb5'], ['sc1', 'sc3'], ['sc1', 'sa2'], ['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa2', 'sa6'], ['sa6', 'sc3'], ['sa6', 'sb5'], ['sa3', 'sc4'], ['sa3', 'sa1'], ['sa3', 'sb2']],</p> <p>'similar': [['ar1', 'ar4'], ['ar1', 'ar2'], ['ar4', 'ar2'], ['ar1', 'ar3'], ['ar4', 'ar3'], ['ar2', 'ar3']]]</p>
<p>set_sum_value('a2', 'c2', 90) set_equal('c1', 'c2') set_sum_value('a1', 'c1', 90)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['b2', 'd4'], ['d4', 'd2'], ['c1', 'c2'], ['b2', 'b1'], ['b1', 'd2'], ['b1', 'd4'], ['a1', 'a2'], ['a2', 'd1']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['a2', 'c2', 90], ['d2', 'b2', 180], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['a2', 'c2', 'd4'], ['c1', 'a2', 90], ['c1', 'a2', 'b2'], ['c1', 'a2', 'd2'], ['c1', 'a2', 'd4'], ['a1', 'c1', 90], ['b1', 'd2', 180], ['b1', 'b2', 180], ['b1', 'd4', 180], ['a2', 'c3', 90], ['d1', 'c2', 90], ['d1', 'c2', 'b2'], ['d1', 'c2', 'd2'], ['d1', 'c2', 'd4'], ['d1', 'c1', 90], ['a1', 'c3', 90], ['d1', 'c3', 90], ['a2', 'c3', 'b1'], ['a1', 'c2', 90], ['a2', 'c3', 'b2'], ['a1', 'c1', 'b1'], ['a2', 'c3', 'd2'], ['a1', 'c1', 'b2'], ['a2', 'c3', 'd4'], ['a1', 'c1', 'd2'], ['a1', 'c1', 'd4'], ['d1', 'c1', 'b2'], ['d1', 'c1', 'd2'], ['d1', 'c1', 'd4'], ['d1', 'c3', 'b1'], ['d1', 'c3', 'b2'], ['d1', 'c3', 'd2'], ['d1', 'c3', 'd4'], ['a2', 'd3', 180], ['a2', 'c1', 'b1'], ['a1', 'c2', 'b2'], ['a1', 'c2', 'd2'], ['a1', 'c2', 'd4'], ['a1', 'c3', 'b1'], ['a1', 'c3', 'b2'], ['a1', 'c3', 'd2'], ['a1', 'c3', 'd4'], ['a2', 'c2', 'b1']],</p> <p>'perpendicular': [['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb4'], ['sa2', 'sb6'], ['sa2', 'sc2'], ['sa4', 'sc4'], ['sa4', 'sa1'], ['sa4', 'sb2'], ['sa6', 'sc4'], ['sa6', 'sa1'], ['sa6', 'sb2'], ['sc1', 'sc4'], ['sc1', 'sa1'], ['sc1', 'sb2']],</p> <p>'similar': [['ar1', 'ar2']]]</p>
<p>set_sum_value('c4', 'b4', 90) set_equal('c1', 'c2') set_parallel('sb1', 'sc2') set_fraction('sb6', 'sc2', 4)</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['c1', 'c2'], ['a3', 'd2'], ['a3', 'b2'], ['b2', 'd4'], ['d4', 'd2'], ['d4', 'a3'], ['a1', 'c3'], ['c3', 'd1'], ['c1', 'a2'], ['a2', 'c2'], ['sa2', 'sc2']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['c4', 'b4', 90], ['b4', 'c4', 'a3'], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['a3', 'd4', 180], ['a3', 'b2', 180], ['a3', 'd2', 180], ['d2', 'b2', 180], ['a2', 'c2', 90], ['b4', 'c4', 'd2'], ['c1', 'c2', 'd2'], ['c1', 'c2', 'b2'], ['c1', 'c2', 'd4'], ['b4', 'c4', 'b2'], ['b4', 'c4', 'd4'], ['a2', 'c1', 90], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['a2', 'c2', 'a3'], ['a2', 'c2', 'd4'], ['c3', 'd3', 180], ['a2', 'c1', 'a3'], ['sc2', 'sb5', 'sc3'], ['sa2', 'sb6', 'sb4'], ['a2', 'c1', 'd2'], ['a2', 'c1', 'b2'], ['a2', 'c1', 'd4']],</p> <p>'perpendicular': [['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sb5'], ['sb1', 'sa2'], ['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb4'], ['sa2', 'sb6'], ['sa2', 'sc2']],</p> <p>'parallel': [['sb1', 'sc2'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sc2', 'sb3'], ['sc2', 'sa5'], ['sb3', 'sb4'], ['sb3', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4']],</p> <p>'similar': [['ar1', 'ar4']],</p> <p>'fraction': [['sb6', 'sc2', 4], ['sb6', 'sa2', 4], ['sb4', 'sc2', 5], ['sb4', 'sa2', 5], ['sb4', 'sb6', 1.25]]]</p>
<p>set_fraction('sb3', 'sb6', 4) set_fraction('sc2', 'sb6', 3) set_equal('a3', 'c3')</p>	<p>{'equal': [['d1', 'a1'], ['d2', 'b2'], ['sb4', 'sb3'], ['a3', 'c3'], ['a2', 'c4'], ['sc4', 'sa3'], ['sa4', 'sc3'], ['b1', 'b4']],</p> <p>'sum_value': [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5',</p>

set_equal('a2','c4')	'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['sb6', 'sc2', 'sb3'], ['sa5', 'sb1', 'sb4'], ['sa6', 'sc1', 'sc3'], ['sb5', 'sa2', 'sa4'], ['sa1', 'sb2', 'sa3']], 'fraction' : [['sb3', 'sb6', 4], ['sc2', 'sb6', 3], ['sb3', 'sc2', 1.3333333333333333], ['sb4', 'sb6', 4], ['sb4', 'sc2', 1.3333333333333333]], 'congruent' : [['ar4', 'ar3']]
set_perpendicular('sb1','sb5') set_perpendicular('sa2','sb4') set_perpendicular('sa4','sb4') set_equal('sc1','sa2')	{'equal' : [['d1', 'a1'], ['d2', 'b2'], ['a3', 'b2'], ['a3', 'd2'], ['c3', 'a1'], ['c3', 'd1'], ['c1', 'a2'], ['b2', 'd4'], ['d4', 'd2'], ['d4', 'a3'], ['b2', 'a1'], ['a1', 'd2'], ['d2', 'd1'], ['d1', 'b2'], ['b2', 'c3'], ['c3', 'd2'], ['c3', 'a3'], ['a3', 'a1'], ['a1', 'd4'], ['d4', 'd1'], ['d1', 'a3'], ['a1', 'd3'], ['d3', 'd1'], ['d3', 'c3'], ['d3', 'b2'], ['d3', 'd2'], ['d3', 'a3'], ['d3', 'd4'], ['d4', 'c3'], ['b1', 'c2'], ['sc1', 'sa2'], ['sa1', 'sb2'], ['sb1', 'sc2']], 'sum_value' : [['a1', 'd3', 180], ['d1', 'd3', 180], ['d2', 'd4', 180], ['b2', 'd4', 180], ['sa5', 'sb1', 'sb3'], ['sa2', 'sb5', 'sc3'], ['sa6', 'sc1', 'sa4'], ['sb6', 'sc2', 'sb4'], ['sa1', 'sb2', 'sc4'], ['b4', 'c4', 90], ['c1', 'c2', 90], ['c1', 'c2', 'a3'], ['b4', 'c4', 'a3'], ['a3', 'd4', 180], ['c1', 'c2', 'b2'], ['c1', 'c2', 'd2'], ['c3', 'd3', 180], ['a2', 'c2', 90], ['a2', 'c2', 'a3'], ['a2', 'c2', 'b2'], ['a2', 'c2', 'd2'], ['b4', 'c4', 'b2'], ['b4', 'c4', 'd2'], ['a3', 'd2', 180], ['c1', 'c2', 'd4'], ['a3', 'b2', 180], ['b2', 'd2', 180], ['a2', 'c2', 'd4'], ['b4', 'c4', 'd4'], ['a3', 'd3', 180], ['c1', 'c2', 'c3'], ['c3', 'd2', 180], ['a2', 'b1', 90], ['b1', 'c1', 90], ['a2', 'b1', 'c3'], ['b4', 'c4', 'c3'], ['c1', 'c2', 'a1'], ['c1', 'c2', 'd1'], ['c1', 'c2', 'd3'], ['b4', 'c4', 'a1'], ['b4', 'c4', 'd1'], ['b4', 'c4', 'd3'], ['b1', 'c1', 'a1'], ['b1', 'c1', 'd1'], ['b1', 'c1', 'c3'], ['b1', 'c1', 'b2'], ['b1', 'c1', 'd2'], ['b1', 'c1', 'a3'], ['b1', 'c1', 'd4'], ['b1', 'c1', 'd3'], ['a2', 'b1', 'a1'], ['a2', 'b1', 'd1'], ['a2', 'b1', 'b2'], ['a2', 'b1', 'd2'], ['a2', 'b1', 'a3'], ['a2', 'b1', 'd3'], ['a2', 'b1', 'd4'], ['a2', 'c2', 'a1'], ['a2', 'c2', 'd1'], ['a2', 'c2', 'c3'], ['a2', 'c2', 'd3'], ['c3', 'a1', 180], ['c3', 'd1', 180], ['c3', 'b2', 180], ['c3', 'a3', 180], ['c3', 'd4', 180], ['a1', 'd1', 180], ['d1', 'b2', 180], ['d1', 'd2', 180], ['d1', 'a3', 180], ['d1', 'd4', 180], ['a1', 'b2', 180], ['a1', 'd2', 180], ['a1', 'a3', 180], ['a1', 'd4', 180], ['d2', 'd3', 180], ['b2', 'd3', 180], ['d4', 'd3', 180], ['sa2', 'sa6', 'sa4'], ['sc2', 'sa5', 'sb3'], ['sb1', 'sb6', 'sb4'], ['sc1', 'sb5', 'sc3']], 'perpendicular' : [['sb1', 'sb5'], ['sb3', 'sc3'], ['sb3', 'sb5'], ['sb3', 'sa2'], ['sa5', 'sc3'], ['sa5', 'sb5'], ['sa5', 'sa2'], ['sb1', 'sc3'], ['sb1', 'sa2'], ['sa2', 'sb4'], ['sc3', 'sb4'], ['sc3', 'sb6'], ['sc3', 'sc2'], ['sb5', 'sb4'], ['sb5', 'sb6'], ['sb5', 'sc2'], ['sa2', 'sb6'], ['sa2', 'sc2'], ['sa4', 'sb4'], ['sa4', 'sb6'], ['sa4', 'sc2'], ['sa6', 'sb4'], ['sa6', 'sb6'], ['sa6', 'sc2'], ['sc1', 'sb4'], ['sc1', 'sb6'], ['sc1', 'sc2'], ['sb3', 'sa4'], ['sb3', 'sa6'], ['sb3', 'sc1'], ['sa5', 'sa4'], ['sa5', 'sa6'], ['sa5', 'sc1'], ['sb1', 'sa4'], ['sb1', 'sa6'], ['sb1', 'sc1']], 'parallel' : [['sb3', 'sb4'], ['sb3', 'sb6'], ['sb3', 'sc2'], ['sc2', 'sa5'], ['sc2', 'sb1'], ['sb1', 'sb4'], ['sb1', 'sb6'], ['sb6', 'sa5'], ['sa5', 'sb4'], ['sa4', 'sc3'], ['sa4', 'sb5'], ['sa4', 'sa2'], ['sa2', 'sa6'], ['sa2', 'sc1'], ['sc1', 'sc3'], ['sc1', 'sb5'], ['sb5', 'sa6'], ['sa6', 'sc3']], 'similar' : [['ar1', 'ar4'], ['ar1', 'ar2'], ['ar4', 'ar2']], 'congruent' : [['ar1', 'ar2']]

Table 1: Problem 1 test cases and solver results

Problem 2

The intersections are on two different sides

Only one vertex of a triangle is inside another triangle

Input	Output
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set_equal('d1','d2')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd2'], ['d2', 'd3']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d3', 'd1', 180]], 'perpendicular' : [['sb1', 'sa2'], ['sb1', 'sa4'], ['sb1', 'sa5'], ['sa3', 'sa2'], ['sa3', 'sa4'], ['sa3', 'sa5'], ['sc4', 'sa2'], ['sc4', 'sa4'], ['sc4', 'sa5']]}
set_equal('sb1','sc1')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['sb1', 'sc1'], ['b1', 'c1']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['sa3', 'sc4', 'sc1'], ['sb3', 'sd4', 'sb1']]}
set_equal('d1','d4') set_equal('sa2','sb2')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd4'], ['d4', 'd3'], ['d3', 'd6'], ['d6', 'd1'], ['d2', 'd5'], ['sa2', 'sb2'], ['a2', 'b2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d1', 'd5', 180], ['d5', 'd3', 180], ['d4', 'd2', 180], ['d6', 'd2', 180], ['sa4', 'sa5', 'sb2'], ['sb4', 'sb5', 'sa2']]}
set_equal('sb1','sb2') set_equal('sc1','sa2') set_equal('a1','c2')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['sb1', 'sb2'], ['sc1', 'sa2'], ['a1', 'c2'], ['b1', 'b2'], ['sa1', 'sc2'], ['c1', 'a2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['sa3', 'sc4', 'sb2'], ['sb4', 'sb5', 'sb1'], ['sb3', 'sd4', 'sa2'], ['sa4', 'sa5', 'sc1']], 'congruent' : [['ar1', 'ar2']]}
set_sum_value('d2','a1',90)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d2', 'a1', 90], ['c2', 'd5', 270]], 'perpendicular' : [['sa2', 'sc1'], ['sa2', 'sb3'], ['sa2', 'sd4'], ['sa4', 'sc1'], ['sa4', 'sb3'], ['sa4', 'sd4'], ['sa5', 'sc1'], ['sa5', 'sb3'], ['sa5', 'sd4']]}
set_sum_value('sc4','sd4',6)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['sc4', 'sd4', 6]]}
set_sum_value('a1','c1',90) set_sum_value('a2','b2',90)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['b1', 'c2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'c1', 90], ['a1', 'c1', 'b1'], ['a2', 'b2', 90], ['b1', 'c2', 180], ['a2', 'b2', 'c2'], ['a2', 'b2', 'b1']], 'perpendicular' : [['sa1', 'sc1'], ['sa1', 'sb3'], ['sa1', 'sd4'], ['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4', 'sb4'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5']]}
set_sum_value('b2','c2',120)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['a2', 'b2'], ['sa2', 'sb2'], ['a2', 'c2'], ['c2', 'b2']],

set_sum_value('a2','c2',120) set_sum_value('d2','d5',90)	['sa2', 'sc2'], ['sc2', 'sb2']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['b2', 'c2', 120], ['a2', 'c2', 120], ['a2', 'b2', 120], ['sa4', 'sa5', 'sb2'], ['sb4', 'sb5', 'sa2'], ['sa4', 'sa5', 'sc2'], ['sb4', 'sb5', 'sc2'], ['d2', 'd5', 90], ['c2', 'a1', 270], ['a2', 'a1', 270], ['b2', 'a1', 270]]}
set_fraction('d1','d2',3)	{'equal': [['d1', 'd3'], ['d4', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction': [['d1', 'd2', 3], ['d3', 'd2', 3]]}
set_fraction('sa2','sb5',4)	{'equal': [['d1', 'd3'], ['d4', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction': [['sa2', 'sb5', 4]]}
set_fraction('d1','d2',3) set_fraction('d4','d1',2)	{'equal': [['d1', 'd3'], ['d4', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction': [['d1', 'd2', 3], ['d3', 'd2', 3], ['d4', 'd1', 2], ['d4', 'd3', 2], ['d6', 'd3', 2], ['d6', 'd1', 2], ['d6', 'd2', 6], ['d4', 'd2', 6]]}
set_fraction('d1','d2',3) set_fraction('d1','d4',2)	{'equal': [['d1', 'd3'], ['d4', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction': [['d1', 'd2', 3], ['d3', 'd2', 3], ['d1', 'd4', 2], ['d1', 'd6', 2], ['d3', 'd6', 2], ['d3', 'd4', 2], ['d4', 'd2', 1.5], ['d6', 'd2', 1.5]]}
set_fraction('d1','d2',3) set_fraction('d4','d1',2) set_fraction('d5','d4',3)	{'equal': [['d1', 'd3'], ['d4', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction': [['d1', 'd2', 3], ['d3', 'd2', 3], ['d4', 'd1', 2], ['d4', 'd3', 2], ['d6', 'd3', 2], ['d6', 'd1', 2], ['d6', 'd2', 6], ['d4', 'd2', 6], ['d5', 'd4', 3], ['d5', 'd6', 3], ['d5', 'd3', 6], ['d5', 'd1', 6], ['d5', 'd2', 18]]}
set_parallel('sa5', 'sb3')	{'equal': [['d1', 'd3'], ['d4', 'd6'], ['a1', 'd1'], ['a1', 'd3'], ['c2', 'd4'], ['c2', 'd6']], 'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd2', 180], ['c2', 'd5', 180]], 'parallel': [['sa5', 'sb3'], ['sa5', 'sc1'], ['sa5', 'sd4'], ['sc1', 'sa2'], ['sc1', 'sa4'], ['sa4', 'sd4'], ['sa4', 'sb3'], ['sb3', 'sa2'], ['sa2', 'sd4']]}
set_parallel('sb3', 'sa4')	{'equal': [['d1', 'd3'], ['d4', 'd6'], ['a1', 'd1'], ['a1', 'd3'], ['c2', 'd4'], ['c2', 'd6'],

set_parallel('sa3', 'sb4')	<p>['a1', 'd4'], ['d4', 'd1'], ['d1', 'd6'], ['d6', 'd3'], ['d3', 'd4'], ['d3', 'c2'], ['c2', 'd1'], ['c2', 'a1'], ['a1', 'd6'], ['d2', 'd5']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd2', 180], ['c2', 'd5', 180], ['d6', 'd2', 180], ['a1', 'd5', 180], ['d4', 'd2', 180], ['d1', 'd5', 180], ['c2', 'd2', 180], ['d3', 'd5', 180]],</p> <p>'parallel': [['sb3', 'sa4'], ['sb3', 'sa2'], ['sb3', 'sa5'], ['sc1', 'sa2'], ['sc1', 'sa5'], ['sc1', 'sa4'], ['sa4', 'sd4'], ['sd4', 'sa2'], ['sd4', 'sa5'], ['sa3', 'sb4'], ['sa3', 'sb2'], ['sa3', 'sb5'], ['sb1', 'sb2'], ['sb1', 'sb4'], ['sb1', 'sb5'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4']]]</p>
set_parallel('sb1', 'sb2') set_parallel('sc1', 'sa2') set_parallel('sa1', 'sc2')	<p>{'equal': [['d1', 'd3'], ['d4', 'd6'], ['a1', 'd4'], ['a1', 'd6'], ['c2', 'd1'], ['c2', 'd3'], ['a1', 'd1'], ['d1', 'd4'], ['d4', 'd3'], ['d3', 'd6'], ['d6', 'd1'], ['d6', 'c2'], ['c2', 'd4'], ['c2', 'a1'], ['a1', 'd3'], ['d2', 'd5'], ['b1', 'b2'], ['c1', 'a2']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd5', 180], ['c2', 'd2', 180], ['d3', 'd5', 180], ['a1', 'd2', 180], ['d4', 'd2', 180], ['d1', 'd5', 180], ['d6', 'd2', 180], ['c2', 'd5', 180]],</p> <p>'parallel': [['sb1', 'sb2'], ['sb1', 'sb4'], ['sb1', 'sb5'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4'], ['sb4', 'sa3'], ['sa3', 'sb2'], ['sc1', 'sa2'], ['sc1', 'sa5'], ['sc1', 'sa4'], ['sa4', 'sd4'], ['sa4', 'sb3'], ['sb3', 'sa2'], ['sb3', 'sa5'], ['sa5', 'sd4'], ['sd4', 'sa2'], ['sa1', 'sc2']],</p> <p>'similar': [['ar1', 'ar2']]]</p>
set_perpendicular('sb1', 'sd4')	<p>{'equal': [['d1', 'd3'], ['d4', 'd6']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['b1', 'c1', 90], ['b1', 'c1', 'a1']],</p> <p>'perpendicular': [['sb1', 'sd4'], ['sb1', 'sc1'], ['sb1', 'sb3'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4']]]</p>
set_perpendicular('sa3', 'sa5') set_perpendicular('sb3', 'sb4')	<p>{'equal': [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd2'], ['d2', 'd3'], ['d1', 'd6'], ['d6', 'd3'], ['d3', 'd4'], ['d4', 'd1'], ['d4', 'd2'], ['d2', 'd6'], ['d1', 'd5'], ['d5', 'd3'], ['d5', 'd2'], ['d5', 'd4'], ['d5', 'd6']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d3', 'd1', 180], ['d6', 'd1', 180], ['d6', 'd3', 180], ['d6', 'd2', 180], ['d6', 'd4', 180], ['d4', 'd1', 180], ['d4', 'd3', 180], ['d4', 'd2', 180], ['d5', 'd1', 180], ['d5', 'd3', 180], ['d5', 'd2', 180], ['c2', 'a1', 180]],</p> <p>'perpendicular': [['sa3', 'sa5'], ['sb1', 'sa2'], ['sb1', 'sa4'], ['sb1', 'sa5'], ['sa3', 'sa2'], ['sa3', 'sa4'], ['sc4', 'sa2'], ['sc4', 'sa4'], ['sc4', 'sa5'], ['sb3', 'sb4'], ['sc1', 'sb2'], ['sc1', 'sb4'], ['sc1', 'sb5'], ['sb3', 'sb2'], ['sb3', 'sb5'], ['sd4', 'sb2'], ['sd4', 'sb4'], ['sd4', 'sb5']]]</p>
set_perpendicular('sa5', 'sa3') set_perpendicular('sb3', 'sb4')	<p>{'equal': [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd2'], ['d2', 'd3'], ['d1', 'd6'], ['d6', 'd3'],</p>

<p>)</p> <p>set_perpendicular('sa1','sc1')</p>	<p>['d3', 'd4'], ['d4', 'd1'], ['d4', 'd2'], ['d2', 'd6'], ['d1', 'd5'], ['d5', 'd3'], ['d5', 'd2'], ['d5', 'd4'], ['d5', 'd6'], ['d1', 'b1'], ['b1', 'd3'], ['b1', 'd2'], ['b1', 'd4'], ['b1', 'd6'], ['b1', 'd5']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d3', 'd1', 180], ['d6', 'd1', 180], ['d6', 'd3', 180], ['d6', 'd2', 180], ['d6', 'd4', 180], ['d4', 'd1', 180], ['d4', 'd3', 180], ['d4', 'd2', 180], ['d5', 'd1', 180], ['d5', 'd3', 180], ['d5', 'd2', 180], ['c2', 'a1', 180], ['b1', 'd4', 180], ['b1', 'd1', 180], ['b1', 'd3', 180], ['b1', 'd2', 180], ['b1', 'd6', 180], ['b1', 'd5', 180], ['a1', 'c1', 90], ['a1', 'c1', 'b1'], ['a1', 'c1', 'd1'], ['a1', 'c1', 'd3'], ['a1', 'c1', 'd2'], ['a1', 'c1', 'd4'], ['a1', 'c1', 'd6'], ['a1', 'c1', 'd5']],</p> <p>'perpendicular': [['sa5', 'sa3'], ['sa2', 'sb1'], ['sa2', 'sa3'], ['sa2', 'sc4'], ['sa4', 'sb1'], ['sa4', 'sa3'], ['sa4', 'sc4'], ['sa5', 'sb1'], ['sa5', 'sc4'], ['sb3', 'sb4'], ['sc1', 'sb2'], ['sc1', 'sb4'], ['sc1', 'sb5'], ['sb3', 'sb2'], ['sb3', 'sb5'], ['sd4', 'sb2'], ['sd4', 'sb4'], ['sd4', 'sb5'], ['sa1', 'sc1'], ['sa1', 'sb3'], ['sa1', 'sd4']],</p> <p>'parallel': [['sa1', 'sb2'], ['sa1', 'sb4'], ['sa1', 'sb5']]]</p>
<p>set_perpendicular('sb1','sa2')</p> <p>set_parallel('sb2','sc4')</p>	<p>'equal': [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd2'], ['d2', 'd3'], ['a1', 'd4'], ['a1', 'd6'], ['c2', 'd1'], ['c2', 'd3'], ['c2', 'd2']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d3', 'd1', 180], ['a1', 'd5', 180], ['c2', 'd2', 180], ['c2', 'd1', 180], ['c2', 'd3', 180], ['a2', 'b2', 90], ['a2', 'b2', 'c2'], ['a2', 'b2', 'd1'], ['a2', 'b2', 'd3'], ['a2', 'b2', 'd2']],</p> <p>'perpendicular': [['sb1', 'sa2'], ['sb1', 'sa4'], ['sb1', 'sa5'], ['sa3', 'sa2'], ['sa3', 'sa4'], ['sa3', 'sa5'], ['sc4', 'sa2'], ['sc4', 'sa4'], ['sc4', 'sa5'], ['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4', 'sb4'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5']],</p> <p>'parallel': [['sb2', 'sc4'], ['sb2', 'sb1'], ['sb2', 'sa3'], ['sa3', 'sb4'], ['sa3', 'sb5'], ['sb5', 'sb1'], ['sb5', 'sc4'], ['sc4', 'sb4'], ['sb4', 'sb1']]]</p>
<p>set_equal('sb1','sc1')</p> <p>set_sum_value('b1','c1',90)</p>	<p>'equal': [['d1', 'd3'], ['d4', 'd6'], ['sb1', 'sc1'], ['b1', 'c1']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['sa3', 'sc4', 'sc1'], ['sb3', 'sd4', 'sb1'], ['b1', 'c1', 90], ['b1', 'c1', 'a1']],</p> <p>'perpendicular': [['sb1', 'sc1'], ['sb1', 'sb3'], ['sb1', 'sd4'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4']]]</p>
<p>set_parallel('sb1','sb2')</p> <p>set_fraction('a1','d5',3)</p>	<p>'equal': [['d1', 'd3'], ['d4', 'd6'], ['a1', 'd4'], ['a1', 'd6'], ['c2', 'd1'], ['c2', 'd3']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd5', 180], ['c2', 'd2', 180]],</p> <p>'parallel': [['sb1', 'sb2'], ['sb1', 'sb4'], ['sb1', 'sb5'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4'], ['sb4', 'sa3'], ['sa3', 'sb2']],</p> <p>'fraction': [['a1', 'd5', 3], ['d4', 'd5', 3], ['d6', 'd5', 3]]}</p>

set_perpendicularr('sa4','sb4') set_equal('a1','c2')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['a1', 'c2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a2', 'b2', 90], ['a2', 'b2', 'c2'], ['a1', 'c2', 180], ['b1', 'c1', 90], ['b1', 'c1', 'a1'], ['b1', 'c1', 'c2'], ['d2', 'd5', 180]], 'perpendicular' : [['sa4', 'sb4'], ['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5'], ['sb1', 'sc1'], ['sb1', 'sb3'], ['sb1', 'sd4'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4']]}
set_fraction('sa3','sd4',2) set_equal('sc4','sa3',2)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['sc4', 'sa3']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2']], 'fraction' : [['sa3', 'sd4', 2], ['sc4', 'sd4', 2], ['sb1', 'sd4', 4], ['sb1', 'sa3', 2.0], ['sb1', 'sc4', 2.0]]}
set_sum_value('a1','d2',90) set_equal('c2','d1') set_fraction('d1','d2',3)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['c2', 'd1'], ['c2', 'd3'], ['a1', 'd4'], ['a1', 'd6']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd2', 90], ['c2', 'd5', 270], ['d3', 'd5', 270], ['d6', 'd2', 90], ['a1', 'd5', 180], ['d1', 'd5', 270], ['c2', 'd2', 180], ['d4', 'd2', 90]], 'perpendicular' : [['sa2', 'sc1'], ['sa2', 'sb3'], ['sa2', 'sd4'], ['sa4', 'sc1'], ['sa4', 'sb3'], ['sa4', 'sd4'], ['sa5', 'sc1'], ['sa5', 'sb3'], ['sa5', 'sd4']], 'parallel' : [['sb1', 'sb2'], ['sb1', 'sb4'], ['sb1', 'sb5'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4'], ['sb4', 'sa3'], ['sa3', 'sb2']], 'fraction' : [['d1', 'd2', 3], ['d3', 'd2', 3], ['c2', 'd2', 3]]}
set_parallel('sb1','sb4') set_parallel('sa2','sc1') set_equal('b1','c1')	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['a1', 'd4'], ['a1', 'd6'], ['c2', 'd1'], ['c2', 'd3'], ['a1', 'd1'], ['d1', 'd4'], ['d4', 'd3'], ['d3', 'd6'], ['d6', 'd1'], ['d6', 'c2'], ['c2', 'd4'], ['c2', 'a1'], ['a1', 'd3'], ['d2', 'd5'], ['b1', 'c1'], ['sb1', 'sc1']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a1', 'd5', 180], ['c2', 'd2', 180], ['d3', 'd5', 180], ['a1', 'd2', 180], ['d4', 'd2', 180], ['d1', 'd5', 180], ['d6', 'd2', 180], ['c2', 'd5', 180], ['sa3', 'sc4', 'sc1'], ['sb3', 'sd4', 'sb1']], 'parallel' : [['sb1', 'sb4'], ['sb1', 'sb2'], ['sb1', 'sb5'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4'], ['sb4', 'sa3'], ['sa3', 'sb2'], ['sa2', 'sc1'], ['sa2', 'sd4'], ['sa2', 'sb3'], ['sb3', 'sa5'], ['sb3', 'sa4'], ['sa4', 'sc1'], ['sa4', 'sd4'], ['sd4', 'sa5'], ['sa5', 'sc1']]}
set_sum_value('a2','b2',90) set_equal('c1','b2') set_sum_value('b1','c1',90)	{ 'equal' : [['d1', 'd3'], ['d4', 'd6'], ['c1', 'b2'], ['c2', 'a1'], ['b1', 'a2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['a2', 'b2', 90], ['a2', 'b2', 'c2'], ['c1', 'a2', 90], ['c1', 'a2', 'c2'], ['b1', 'c1', 90], ['c2', 'a1', 180], ['b1', 'b2', 90], ['b1', 'b2', 'c2'], ['b1', 'c1', 'c2'], ['d2', 'd5', 180], ['b1', 'c1', 'a1']], 'perpendicular' : [['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4',

	'sb4'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5'], ['sb1', 'sc1'], ['sb1', 'sb3'], ['sb1', 'sd4'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4']], 'similar' : [['ar1', 'ar2']]
set_sum_value('c1', 'b1', 90) set_equal('a1', 'c2') set_parallel('sb1', 'sb2') set_fraction('sb4', 'sb5', 4)	'equal' : [['d1', 'd3'], ['d4', 'd6'], ['a1', 'c2'], ['a1', 'd4'], ['a1', 'd6'], ['d6', 'c2'], ['c2', 'd4'], ['a1', 'd5'], ['d5', 'c2'], ['d5', 'd6'], ['d5', 'd4'], ['a1', 'd1'], ['a1', 'd3'], ['d3', 'c2'], ['c2', 'd1'], ['d1', 'd6'], ['d6', 'd3'], ['d3', 'd4'], ['d4', 'd1'], ['d1', 'd5'], ['d5', 'd3'], ['a1', 'd2'], ['d2', 'c2'], ['d2', 'd6'], ['d2', 'd4'], ['d2', 'd5'], ['d2', 'd1'], ['d2', 'd3']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['c1', 'b1', 90], ['b1', 'c1', 'a1'], ['a1', 'c2', 180], ['d2', 'd5', 180], ['a2', 'b2', 90], ['a2', 'b2', 'c2'], ['a2', 'b2', 'a1'], ['d4', 'a1', 180], ['d4', 'c2', 180], ['d4', 'd6', 180], ['d6', 'a1', 180], ['d6', 'c2', 180], ['d4', 'd2', 180], ['a1', 'd5', 180], ['c2', 'd5', 180], ['d3', 'd4', 180], ['d3', 'a1', 180], ['d3', 'c2', 180], ['d3', 'd6', 180], ['d3', 'd5', 180], ['d3', 'd1', 180], ['d1', 'a1', 180], ['d1', 'c2', 180], ['d1', 'd4', 180], ['d1', 'd6', 180], ['d1', 'd5', 180], ['d2', 'a1', 180], ['d2', 'c2', 180], ['d2', 'd6', 180], ['b1', 'c1', 'c2'], ['b1', 'c1', 'd4'], ['b1', 'c1', 'd6'], ['b1', 'c1', 'd5'], ['b1', 'c1', 'd1'], ['b1', 'c1', 'd3'], ['b1', 'c1', 'd2'], ['a2', 'b2', 'd6'], ['a2', 'b2', 'd4'], ['a2', 'b2', 'd5'], ['a2', 'b2', 'd3'], ['a2', 'b2', 'd1'], ['a2', 'b2', 'd2']], 'perpendicular' : [['sb1', 'sc1'], ['sb1', 'sb3'], ['sb1', 'sd4'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4'], ['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4', 'sb4'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5'], ['sb1', 'sa2'], ['sb1', 'sa4'], ['sb1', 'sa5'], ['sa3', 'sa2'], ['sa3', 'sa4'], ['sa3', 'sa5'], ['sc4', 'sa2'], ['sc4', 'sa4'], ['sc4', 'sa5'], ['sc1', 'sb2'], ['sc1', 'sb4'], ['sc1', 'sb5'], ['sb3', 'sb2'], ['sb3', 'sb4'], ['sb3', 'sb5'], ['sd4', 'sb2'], ['sd4', 'sb4'], ['sd4', 'sb5']], 'parallel' : [['sb1', 'sb2'], ['sb1', 'sb4'], ['sb1', 'sb5'], ['sa2', 'sc1'], ['sa2', 'sd4'], ['sa2', 'sb3'], ['sc1', 'sa5'], ['sc1', 'sa4'], ['sb3', 'sa5'], ['sb3', 'sa4'], ['sd4', 'sa5'], ['sd4', 'sa4'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sc4', 'sb4'], ['sb4', 'sa3'], ['sa3', 'sb2']], 'fraction' : [['sb4', 'sb5', 4], ['sb2', 'sb5', 5], ['sb2', 'sb4', 1.25]]
set_fraction('sb1', 'sb4', 3) set_fraction('sb5', 'sb4', 2) set_equal('a1', 'c2') set_equal('a2', 'c1')	'equal' : [['d1', 'd3'], ['d4', 'd6'], ['sb2', 'sb1'], ['a1', 'c2'], ['a2', 'c1'], ['sc1', 'sa2'], ['sa1', 'sc2'], ['b1', 'b2']], 'sum_value' : [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['sb4', 'sb5', 'sb1'], ['sa3', 'sc4', 'sb2'], ['sb3', 'sd4', 'sa2'], ['sa4', 'sa5', 'sc1']], 'fraction' : [['sb1', 'sb4', 3], ['sb5', 'sb4', 2], ['sb1', 'sb5', 1.5], ['sb2', 'sb4', 3], ['sb2', 'sb5', 1.5]], 'congruent' : [['ar1', 'ar2']]
set_perpendicular('sb1', 'sa2') set_perpendicular('sc1', 'sb2') set_parallel('sa1', 'sc2')	'equal' : [['d1', 'd3'], ['d4', 'd6'], ['d1', 'd2'], ['d2', 'd3'], ['d1', 'd6'], ['d6', 'd3'], ['d3', 'd4'], ['d4', 'd1'], ['d4', 'd2'], ['d2', 'd6'], ['d1', 'd5'], ['d5', 'd3'],

set_equal('sc1', 'sa2')	<p>['d5', 'd2'], ['d5', 'd4'], ['d5', 'd6'], ['a1', 'd4'], ['a1', 'd6'], ['a1', 'd1'], ['a1', 'd3'], ['a1', 'd2'], ['a1', 'd5'], ['c2', 'd1'], ['c2', 'd3'], ['c2', 'd2'], ['c2', 'd4'], ['c2', 'd6'], ['c2', 'd5'], ['c2', 'a1'], ['sc1', 'sa2']],</p> <p>'sum_value': [['d1', 'd2', 180], ['d2', 'd3', 180], ['d4', 'd5', 180], ['d5', 'd6', 180], ['sa3', 'sc4', 'sb1'], ['sb3', 'sd4', 'sc1'], ['sa4', 'sa5', 'sa2'], ['sb4', 'sb5', 'sb2'], ['d3', 'd1', 180], ['d6', 'd1', 180], ['d6', 'd3', 180], ['d6', 'd2', 180], ['d6', 'd4', 180], ['d4', 'd1', 180], ['d4', 'd3', 180], ['d4', 'd2', 180], ['d5', 'd1', 180], ['d5', 'd3', 180], ['d5', 'd2', 180], ['c2', 'a1', 180], ['d5', 'c2', 180], ['d5', 'a1', 180], ['d1', 'a1', 180], ['d3', 'a1', 180], ['d2', 'a1', 180], ['d4', 'a1', 180], ['d6', 'a1', 180], ['c2', 'd1', 180], ['c2', 'd4', 180], ['c2', 'd6', 180], ['c2', 'd3', 180], ['c2', 'd2', 180], ['a2', 'b2', 90], ['a2', 'b2', 'c2'], ['a2', 'b2', 'd1'], ['a2', 'b2', 'd3'], ['a2', 'b2', 'd2'], ['a2', 'b2', 'd4'], ['a2', 'b2', 'd6'], ['a2', 'b2', 'd5'], ['a2', 'b2', 'a1'], ['b1', 'c1', 90], ['b1', 'c1', 'a1'], ['b1', 'c1', 'd4'], ['b1', 'c1', 'd6'], ['b1', 'c1', 'd1'], ['b1', 'c1', 'd3'], ['b1', 'c1', 'd2'], ['b1', 'c1', 'd5'], ['b1', 'c1', 'c2'], ['sb3', 'sd4', 'sa2'], ['sa4', 'sa5', 'sc1']],</p> <p>'perpendicular': [['sb1', 'sa2'], ['sb1', 'sa4'], ['sb1', 'sa5'], ['sa3', 'sa2'], ['sa3', 'sa4'], ['sa3', 'sa5'], ['sc4', 'sa2'], ['sc4', 'sa4'], ['sc4', 'sa5'], ['sc1', 'sb2'], ['sc1', 'sb4'], ['sc1', 'sb5'], ['sb3', 'sb2'], ['sb3', 'sb4'], ['sb3', 'sb5'], ['sd4', 'sb2'], ['sd4', 'sb4'], ['sd4', 'sb5'], ['sa2', 'sb2'], ['sa2', 'sb4'], ['sa2', 'sb5'], ['sa4', 'sb2'], ['sa4', 'sb4'], ['sa4', 'sb5'], ['sa5', 'sb2'], ['sa5', 'sb4'], ['sa5', 'sb5'], ['sb1', 'sc1'], ['sb1', 'sb3'], ['sb1', 'sd4'], ['sa3', 'sc1'], ['sa3', 'sb3'], ['sa3', 'sd4'], ['sc4', 'sc1'], ['sc4', 'sb3'], ['sc4', 'sd4']],</p> <p>'parallel': [['sb4', 'sc4'], ['sb4', 'sb1'], ['sb4', 'sa3'], ['sb1', 'sb2'], ['sb1', 'sb5'], ['sb5', 'sa3'], ['sb5', 'sc4'], ['sc4', 'sb2'], ['sb2', 'sa3'], ['sa2', 'sc1'], ['sa2', 'sd4'], ['sa2', 'sb3'], ['sb3', 'sa5'], ['sb3', 'sa4'], ['sa4', 'sc1'], ['sa4', 'sd4'], ['sd4', 'sa5'], ['sa5', 'sc1']]]</p>
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Table 2: Problem 2 test cases and solver results