SANTA'S ROUTE

Instructions: Santa still has twelve cities left on his Christmas Eve trip. The distances between the cities are shown in the table.

Cities	Cairo	Calcutta	Chicago	Lisbon	London	Manila	Moscow	Paris	Rome	Sydney	Tokyo	Warsaw
Cairo	miles	3,539	6,129	2,363	2,181	5,704	1,803	1,995	1,320	8,952	5,935	1,630
Calcutta	3,539	miles	7,980	5,638	4,947	2,203	3,321	4,883	4,482	5,685	3,194	4,048
Chicago	6,129	7,980	miles	3,990	3,950	8,143	4,974	4,134	4,808	9,272	6,299	4,667
Lisbon	2,363	5,638	3,990	miles	985	7,546	2,427	904	1,161	11,302	6,915	1,715
London	2,181	4,947	3,950	985	miles	6,672	1,555	213	887	10,564	5,940	899
Manila	5,704	2,203	8,143	7,546	6,672	miles	5,131	6,677	6,457	3,944	1,866	5,837
Moscow	1,803	3,321	4,974	2,427	1,555	5,131	miles	1,544	1,474	9,012	4,647	715
Paris	1,995	4,883	4,134	904	213	6,677	1,544	miles	697	10,544	6,034	849
Rome	1,320	4,482	4,808	1,161	887	6,457	1,474	697	miles	10,136	6,135	817
Sydney	8,952	5,685	9,272	11,302	10,564	3,944	9,012	10,544	10,136	miles	4,866	9,696
Tokyo	5,935	3,194	6,299	6,915	5,940	1,866	4,647	6,034	6,135	4,866	miles	5,249
Warsaw	1,630	4,048	4,667	1,715	899	5,837	715	849	817	9,696	5,249	miles

How far is it from Paris to Cairo?

How far is it from Sydney to Rome?

If Santa travelled from Chicago to Rome then to Warsaw, how far would he have travelled?

How far would Santa travel if he went from Manila to Calcutta to London to Moscow?

How far would Santa travel if he went to each city in alphabetical order, starting in Cairo and ending in Warsaw?

Find a route for Santa to follow that is as short as possible. After you have found a route, compare it to others to see if they found a shorter route.

Merry Christmas from Math-Drills.Com

Santa's Route Answers

Instructions: Santa still has twelve cities left on his Christmas Eve trip. The distances between the cities are shown in the table.

Cities	Cairo	Calcutta	Chicago	Lisbon	London	Manila	Moscow	Paris	Rome	Sydney	Tokyo	Warsaw
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Rome	1,320	4,482	4,808	1,161	887	6,457	1,474	697	miles	10,136	6,135	817
Sydney	8,952	5,685	9,272	11,302	10,564	3,944	9,012	10,544	10,136	miles	4,866	9,696
Tokyo	5,935	3,194	6,299	6,915	5,940	1,866	4,647	6,034	6,135	4,866	miles	5,249
Warsaw	1,630	4,048	4,667	1,715	899	5,837	715	849	817	9,696	5,249	miles

How far is it from Paris to Cairo?   1,995 miles

How far is it from Sydney to Rome?   10,136 miles

If Santa travelled from Chicago to Rome then to Warsaw, how far would he have travelled?
   4,808   +   817   =   5,625   miles

How far would Santa travel if he went from Manila to Calcutta to London to Moscow?
   2,203   +   4,947   +   1,555   =   8,705 miles

How far would Santa travel if he went to each city in alphabetical order, starting in Cairo and ending in Warsaw?

   50,789 miles   Students add all the numbers in the blue boxes (shown above) OR all of numbers in the green boxes to find this sum. You can discuss the pattern and how they found it.

Find a route for Santa to follow that is as short as possible. After you have found a route, compare it to others to see if they found a shorter route.

Try to view this question as open-ended, or your student(s) might be working on it for days. You might compare answers of several students or challenge students to find a route that is even shorter than the one they already found. There is a lot of opportunity here to discuss strategies for finding the shortest route (e.g. crossing out the cities already travelled to and finding the lowest mileage out of what is left). Some students might question where Santa was starting from as this would affect the total distance if, say, he had to travel from New York first to get to the first location. Have fun and Merry Christmas! And if someone figures out the best answer to this question, please let me know and I'll add it here.

Merry Christmas from Math-Drills.Com

Fwd: Santa's Route

3 messages

Paul A. Rubin   **Sun, Jan 9, 2011 at 6:38 PM**

To: math-drills.com

Hi again,

Rereading the problem, it occurred to me that you might have intended a simple path and not a Hamiltonian circuit (i.e., no need to return to the beginning of the route). In that case, one solution is

   Sydney -> Tokyo -> Manila -> Calcutta -> Cairo -> Moscow -> Warsaw -> Rome -> Paris -> London -> Lisbon -> Chicago

with a distance of 21,694 miles.

Cheers,
Paul

-------- Original Message --------
      Subject: Santa's Route
         Date: Fri, 24 Dec 2010 15:27:53 -0500
       From: Paul A. Rubin
Organization: Michigan State University
          To: Math-drills.com

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Hi,

The optimal solution to your 12 city Traveling Santa Problem is

Cairo -> Calcutta -> Manila -> Sydney -> Tokyo -> Chicago -> Lisbon ->
London -> Paris -> Rome -> Warsaw -> Moscow -> (Cairo)

with total distance 30,071 miles.

I blogged a bit about the problem at
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http://orinanobworld.blogspot.com/2010/12/seasonal-tsp-traveling-santa-problem.html.
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Thanks for providing me a little diversion on Christmas Eve.

Paul Rubin
Professor of Management Science
Michigan State University
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