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Air Distance and Bearing

As part of a unit on Trigonometry, we review compass and true bearings before working with bearings in Trigonometry problems.
To start this review lesson, we looked at some images from Google Earth.

Bearing 272° Switzerland Neuchatel Airport .- Distance 23.9 Nautical Miles

It is very important in aviation to have knowledge of the nearby airports at any time in flight. The task is the following:

Determine the distance and bearing from an Airplane to the 20 nearest Airports whenever requested. Use the non-commercial data from openflights.org airports.dat as reference.

A request comes from an airplane at position (latitude, longitude): (**46.94797, 7.44745**). This is the place where the famous **Zytglogge** Tower (Clock Tower) at Bern Capital of Switzerland is.


```
{"png":"https://mainfacts.com/media/images/coats_of_arms/ch.png","svg":"https://
```


Latitude and Longitude are the units that represent the *coordinates at*

geographic coordinate system.

Task Solution

Your report should contain the following information from table airports.dat (column shown in brackets below):

ICAO Distance Bearing Country Airport

. . .

```
LSZB 2.9 135 Switzerland Bern Belp Airport
//46.914100647,7.497149944309999
LSZP 10.6 323 Switzerland Biel-Kappelen Airport
LSZW 13.1 151 Switzerland Thun Airport
LSZG 14.1 355 Switzerland Grenchen Airport
//"ZHI","LSZG",47.181599,7.41719,1411,1,"E","Europe/Zurich",ts
LSGE 19.1 233 Switzerland Ecuvillens Airport
```

Name(2), Country(4), ICAO(6), Distance and Bearing calculated from Latitude(7) and Longitude(8).

```
procedure FindNearest(var testKoors:tDst_Bear;cntAirports,cntNearest:Integer);
var i: Int32;
begin
  Init_MinSol(cntNearest);
  For i:= 0 to cntAirports-1 do Begin
    testKoors.Koor2:= AirPorts[i].Sol_Koor;
    Calc_Dist_bear(testKoors);
    Insert_Sol(testKoors,i);
  end;
end;
```

Distance is measured in nautical miles (NM). Resolution is 0.1 NM.

Bearing is measured in degrees (°). 0° = 360° = north then clockwise 90° = east, 180° = south, 270° = west. Resolution is 1°.

```
procedure Out_MinSol;
var
```

```
    i: integer;
  begin
  writeln(' ICAO Distance Bearing Country        Airport');
  writeln(' ---- -------- ------- -------------- ---------');
    For i:= 0 to minSols.actidx do
      with AirPorts[minSols.sols[i].AirportIdx] do
        writeln(Format(' %4s %8.1f %7.0f %-14s  %-35s',
                       [Sol_ICAO,
                        Sol_dist_dir.distance*DiaEarth,
                        Sol_dist_dir.bearing*cRadToDeg,
                        Sol_Country,Sol_Name]));
    writeln('');
    writeln(itoa(cntInserts)+' inserts to find them');
  end;
```

The output shows distance and bearing from the point of view, in our example the Zytglogge-Tower. Bearing is the angle to the next airport:

LSZB 2.9 135 Switzerland Bern Belp Airport

3469 ms for reading airports.dat
30531 ms for searching 100 times of 20 nearest out of 7698 airports
202 inserts to find them

Nearest to latitude 46.94797,longitude 7.44745 degrees

1676,”Bern Belp Airport”,”Bern”,”Switzerland”,”BRN”,”LSZB”,46.914100647,7.497149944309999,1674,1,”E”

Thats what the image detector (apilayer) from the map sees:

URL_APILAY = ‘https://api.apilayer.com/image_to_text/url?url=%s';

{“lang”: “und”, “all_text”: “Coordinates\n50 m\n605101, 195119\n46.90716, 7.50559\n32\nplatzstrasse\n*\n…\nP”, “annotations”: [“Coordinates”, “50”, “m”, “605101”, “,”, “195119”, “46.90716”, “,”, “7.50559”, “32”, “platzstrasse”, “”, ““, “…”, “P”]}

On the other side of the runway you see **14** that means 32–18= 14 or **140**° in the opposite direction (reciprocal calculation).

ICAO Distance Bearing Country Airport

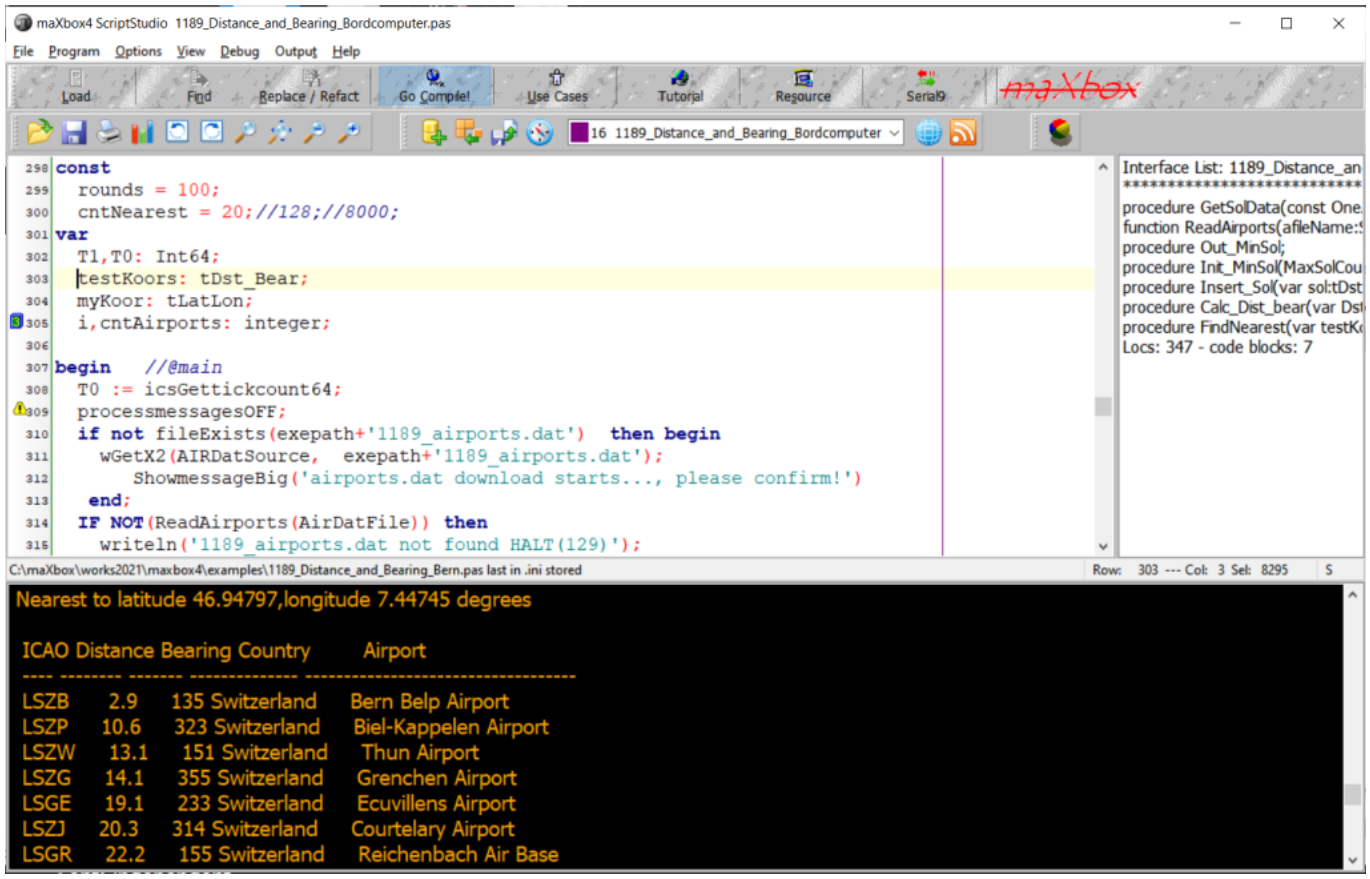
LSZB 2.9 135 Switzerland Bern Belp Airport
LSZP 10.6 323 Switzerland Biel-Kappelen Airport
LSZW 13.1 151 Switzerland Thun Airport
LSZG 14.1 355 Switzerland Grenchen Airport
LSGE 19.1 233 Switzerland Ecuvillens Airport
LSZJ 20.3 314 Switzerland Courtelary Airport
LSGR 22.2 155 Switzerland Reichenbach Air Base
LSMP 22.7 254 Switzerland Payerne Air Base
LSGN 23.9 272 Switzerland Neuchatel Airport
LSMI 24.1 132 Switzerland Interlaken Air Base
LSTS 27.1 183 Switzerland St Stephan Airport
LSGC 28.0 287 Switzerland Les Eplatures Airport

LSGK 28.8 196 Switzerland Saanen Airport
LSMM 29.8 114 Switzerland Meiringen Airport
LSPO 29.9 37 Switzerland Olten Airport
LSPN 30.7 57 Switzerland Triengen Airport
LSZQ 31.7 328 Switzerland Bressaucourt Airport
LSZO 34.2 65 Switzerland Luzern-Beromunster Airport
LSMA 34.3 90 Switzerland Alpnach Air Base
LSGY 36.0 252 Switzerland Yverdon-les-Bains Airport

202 inserts to find them
mX4 executed: 23/02/2023 13:26:09 Runtime: 0:0:36.103 Memload: 44% use

```
OpenWeb('https://www.latlong.net/c/?lat='+flots(myKoor.lat/cDegToRad)+
'&long='+flots(myKoor.lon/cDegToRad));
```

Data: openflights.org/data: Airport, airline and route data



Script: 1189_Distance_and_Bearing_Bordcomputer.pas Compiled done: 23/02/2023 13:25:35

A good discussion to start thinking about bearings, how they fit into 360°, how standards are used around the world and why true bearings are often used rather than compass bearings and what's the difference to heading.

Heading is the direction the airplane is pointed, whereas track is the actual direction of the airplane tracking across the ground. Bearing is the angle between any two points, whereas course is your intended path of travel to your destination.

https://airplaneacademy.com/heading-track-bearing-and-course-explained/

[You might also want to read How Runways Are Designated

Max Kleiner, 23/02/2023

https://i.ytimg.com/vi/AusL233-E6E/hq720_2.jpg?sqp=-oaymwEdCJUDENAFSFXyq4qpAw8IARUAAIhCcAHAAQbQAQE=&rs=AOn4CLA5MqpJNN8pTuo4XUyCyUn-vta2tA

GIS Geocoding Flight Navigation Maxbox4