ES 734/834 CLASS PROGRAMS

INTRODUCTION

For this class there are five programs that you will have to use for labs and homework. These programs are written in TrueBASIC and can be found on the class web site. To run them requires that True BASIC be on the computer (it is on the machines in the Tischler Classroom).

If the system is working correctly, the programs will load and run automatically. If it isn't, you may have to track down the TrueBasic application ("Hello") and click on it. Then enter "old *program name*" to load the program.

BISONInteractive*.TRU

This program can be used to find the parameters of dipping layer seismic refraction models for lab or homework. It was adapted by FSB from one in the "Handbook of Engineering Geophysics" (H. M. Mooney, 1973, Bison Instruments, Minneapolis).

This is a compiled program that you cannot alter in any way. You just enter the various items in the correct order (see handout below).. Be sure that corresponding time intercepts are the same ("condition of reciprocity) or the program will not run.

Regardless of what the table headings say the results are in English units (feet, feet per second) if the profile length is given in feet. If it's given in meters, the results are in metric units (m, m/s) regardless of what the table heading says!

TTIME.TRU

You may want to use this original FSB program to calculate travel times for horizontal layer models ("forward modelling"). To run it you must specify layer velocities and thicknesses. The output is a travel-time plot.

This program is not compiled. As with any uncompiled programs you should immediately make a working copy with a new name. Never, never alter the original version. If you want to make changes make them to the working copy only (see WENNER.TRU).

WENNER.TRU

You can use this program to forward model resitivity soundings or to interpret field data by trial-and-error modelling. This program is a translation by FSB of a Fortran program in O. Koefoed's "Geosounding Principles" (1979, Elsevier, Amsterdam).

The program is not compiled so make a working copy as described under TTIME. There are two changes you may want to make.

To use field data you'll have to enter the number of pairs of readings plus the electrode spacing and apparent resistivity of each pair (see handout). Use an exclamation mark (!) to disable unwanted lines and enter your data as shown on the handout.

You may also want to change the limits of spacing and apparent resistivity of the output graph. This is done by altering line 210 as explained on the handout.(see below).

SCHLUMBERGER.TRU

This uncompiled program is also from Koefoed's book. It runs in just the same way as "WENNER" except that you must enter two numbers about the output graph. "First abcissa" is the smallest electrode spacing for which you want output (usually 1 m). Make "Number of data points" big enough to extend the curve as far to the right as you wish.

To enter field data or change plot limits follow the "WENNER" instructions.

TALWANI.TRU

This is a complied program rewritten from one by the late Professor Charles Drake of Dartmouth University. We'll use it in lab to make a cross-section of the Exeter pluton by trial-and-error modelling of Bouguer gravity anomalies . Detailed instructions are given below and also in the lab handout.

PRINTING RESULTS

Printing always seems to be a hassle. Depending on just how the machines are set up, printing may be trivial or a nightmare. For example you may have to do a screen copy and then paste it in a “Paint” program. Probably a classmate can help you. I’ll do my best also. In mast cases the printouts will be black on white even though the screen shows green on black.

"BISON Interactive *"

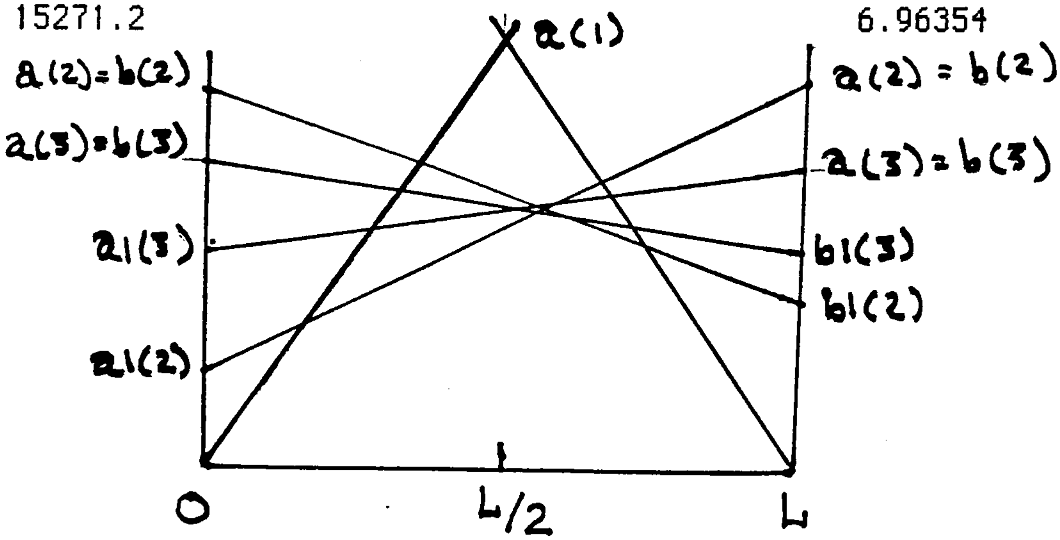
Bison Graphics

COMPUTER PROGRAM FOR SEISMIC REFRACTION

You can use the program "BISON Interactive*" to interpret first-arrival seismic refraction data in terms of models with constant layer velocities and dipping interfaces. It is really the same as the old program "BISON" but has been rewritten as a compiled program for interactive use. That is, you don't have to change any DATA statements within the program; it all runs with INPUTcommands. You start the program by clicking on the name or icon and then clicking on RUN or the green light.

The first prompt (enter title ?) requires some character such as line number, date, etc. (see below). Type a number and press the RETURN key. At the next prompt enter the number of layers (includes underlying half-space), the length of the line in meters and the time (ms) where the direct arrival lines cross in the center of the profile. The final series of prompts ask for the time intercepts for the separate layer arrivals. Enter in the sequence shown in the sketch. Note that the far end intercept is entered twice. These intercepts have to be the same (reciprocity!) or the program will stop. Here's a sample printout:

```
enter title
? #1
enter # layers,length (m),direct crossover time
? 4,100,42.5                                   [N, L, a(1)]
enter A and B intercepts layer by layer
? 10,29,10,29                                [a1(2), a(2), b1(2), b(2)]
? 13,27,13,27                                [a1(3), a(3), b1(3), b(3)]
? 19,24,16,24                                  etc.
layer v(m/s)  thickness(m)    depth(m)              dip(o)
 1   1176.47  6.03506  6.03506  6.03506  6.03506
 2   5263.16  11.2124  11.2124  17.2475  17.2475  .001
 3   7142.86  19.4761  7.26405  36.7236  24.5115  .001
 4   15271.2                                      6.96354
?
```



Save under another name!

"WENNER (FSB) - plot"

This program can be used to "forward model" Wenner array soundings. I've adapted it from one in O. Koefoed's book, "Geosounding Principles" (1979, Elsevier, Amsterdam).

The program can be found on the class disk or on some of the Mac harddrives.

After calling up the program, the first step is to replace the test data with your own data. The data goes in line 900 and subsequent lines.

```
{ 900  DATA  12  ⟶  12 pairs of a, ρa
{ 902  DATA  1, 125, 2, 136, ....
{              ↑   ↑    ↑   ↑
{              a1  ρa1  a2  ρa2  etc
```

Then RUN the program. It will ask for "NUMBER OF LAYERS"? Give it the number of layers including the underlying half-space. Hit RETURN.

Then "GIVE RESISTIVITIES"? Enter one at a time hitting RETURN after each.

Then "GIVE THICKNESSES"? Enter one at a time with RETURN. Do not include half-space.

Output shows data and model on log-log scale. If your data (squares) are off-scale you'll have to change line 210.

```
210 SET WINDOW LOG(.9), LOG(110), LOG(30), LOG(11000)
                    ↗          ↗         ↖          ↗
                      limits of a          limits of ρa
```

Only change these up or down by a factor of 10. Change only both for a or both for ρa or all four.

"Talwani"

COMPUTER GRAVITY MODELLING

The purpose of this exercise is to understand how gravity data can be interpreted using "trial and error" computer modelling. In this method a succession of models ~~are~~ is tested until one (or more) is found that satisfies both the gravity data and the geological constraints.

The program for this exercise was written by Professor Charles Drake of Dartmouth College based of the "Talwani" program for two-dimensional bodies (Talwani et al.,1959). It should only be used for bodies that are much longer than they are wide; the profile should be taken at right angles to the long axis of the body. The ground surface is flat.

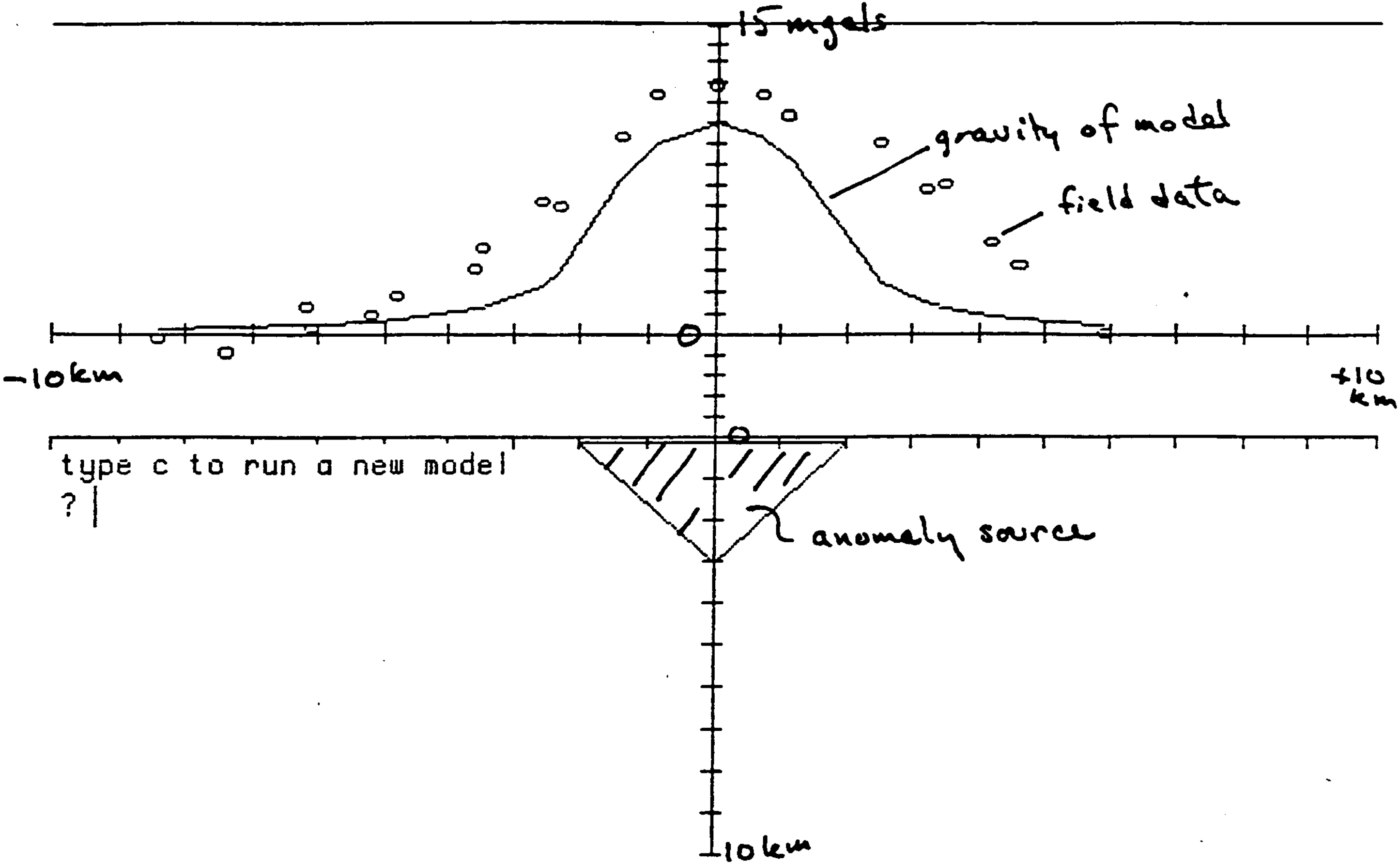
When you run the program you will have to answer several questions. The first is the "number of polygons" or bodies of anomalous density. Normally the answer is 1. The next question is the value (gm/cm3) of the "density contrast"; in other words the difference in density between the body and the surrounding rock. Then you will be asked for the "number of vertices" in the model. This is 3 for a triangular cross-section, 4 for a quadrilateral one and so on. The final inputs are the coordinates (km) of the vertices. The horizontal axis is positive to the right and the vertical axis is positive downward (you can not use a vertical coordinate value of zero). Note that you must enter the first vertex coordinates again at the end!

The gravity data are already in the program. They are from a profile trending 105^0 across the Exeter diorite pluton in southeastern New Hampshire. The left end is the west end and the right is the east. The origin of the coordinates is at the train station ("Dairy Bar") in Durham. Outcrops of diorite are found between -2 and +4 km along the profile.

The computer output includes a graph of gravity data (circles) and calculated gravity (continuous line). The horizontal axis extends from -10 to +10 km; the vertical axis, from -5 to +15 mgals. The lower picture is a cross-section of the body. The horizontal axis extends from -10 to +10 km and the vertical axis extends from 0 (the surface) down to 10 km underground.

Hand In:

Successful models + 1-page report


15 mgals
gravity of model
field data
-10km
+10 km
type c to run a new model
?
anomaly source
10km