

GEOL4714 Final Exam
 Fall 2005, C. H. Jones instructor

Name: _____

Student ID #: _____

Feel free to use the back of the sheets for answers needing more space.

(1) (10 pts) For each of the possible targets below, list one of the best techniques and one of the worst of those that we used in class:

<i>Target</i>	<i>Best technique</i>	<i>Worst technique</i>
Salt water under freshwater		
Denver Basin thickness		
Buried pueblo ruin		
Metal utility pipe		
Depth to the water table		

(2) (10 pts) Identify 4 deficiencies (omissions or improper usages) in the fieldbook entry below:

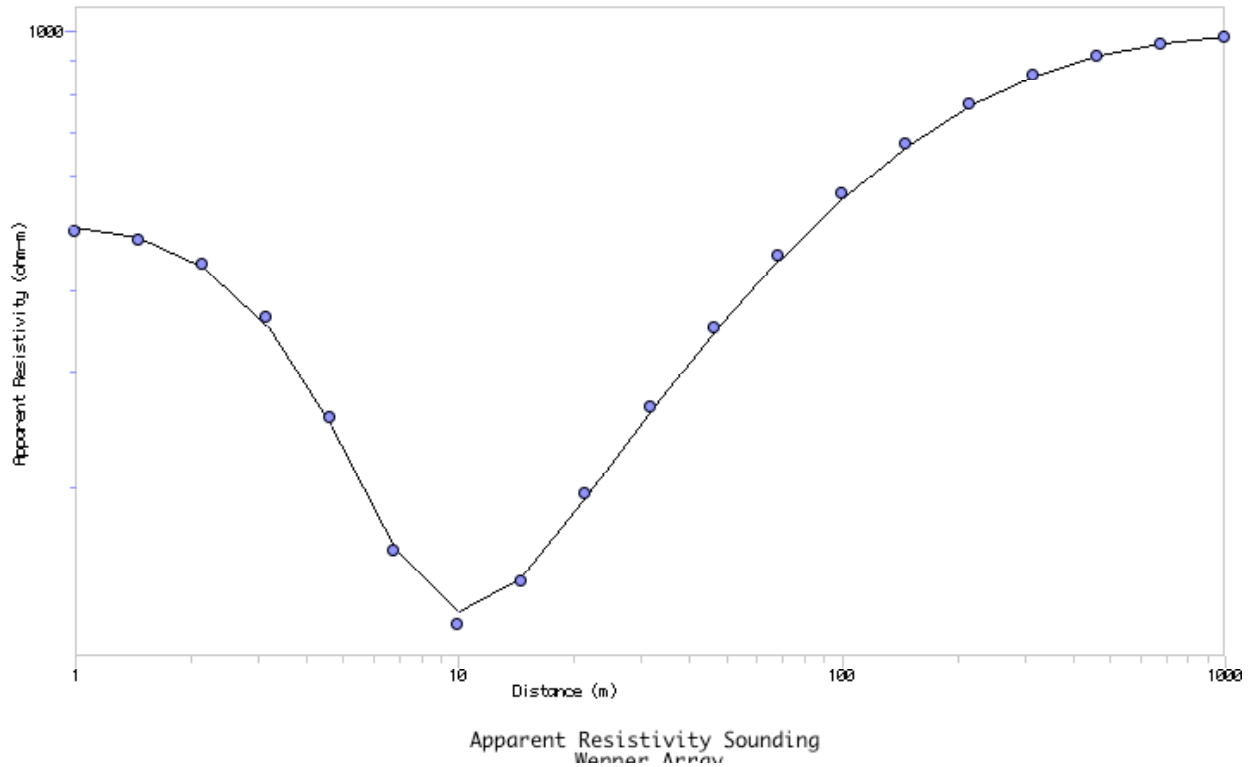
October 19
 Gravity survey, Boulder County, Colorado
 Real-time differential kinematic GPS system from UNAVCO used
 Scribe: Marty Malaprop
 Reader: Sue Shakey.

	Reading	Latitude	Longitude	Elevation (m)
Base Measurement	4011.122	40.00122	105.4302	2011.1
	4011.143			
	4011.121			
	4011.163			
	4011.170			
05-011-01	4015.221	40.00223	105.4558	2002.1
	4015.200			
	4015.238			
05-011-02	4005.988	40.00388	105.4678	2112.7
	4006.198			
	4006.001			

(3) (a; 5 points) Suppose you made a gravity measurement at a spot near some hills, and a developer came and bladed the entire area down to the same elevation as your gravity spot. If you now remeasured gravity at that spot, would it be different? If so, what correction from the first measurement (if any) would the difference be the same as?

(b; 5 points) Now suppose you took a measurement in a fire tower and one at the base of the fire tower. The difference between the two measurements would be equivalent to what standard gravity correction (if the second measurement was your local base station)?

(4) (10 pts) Consider the fit to Wenner-array resistivity data shown below.



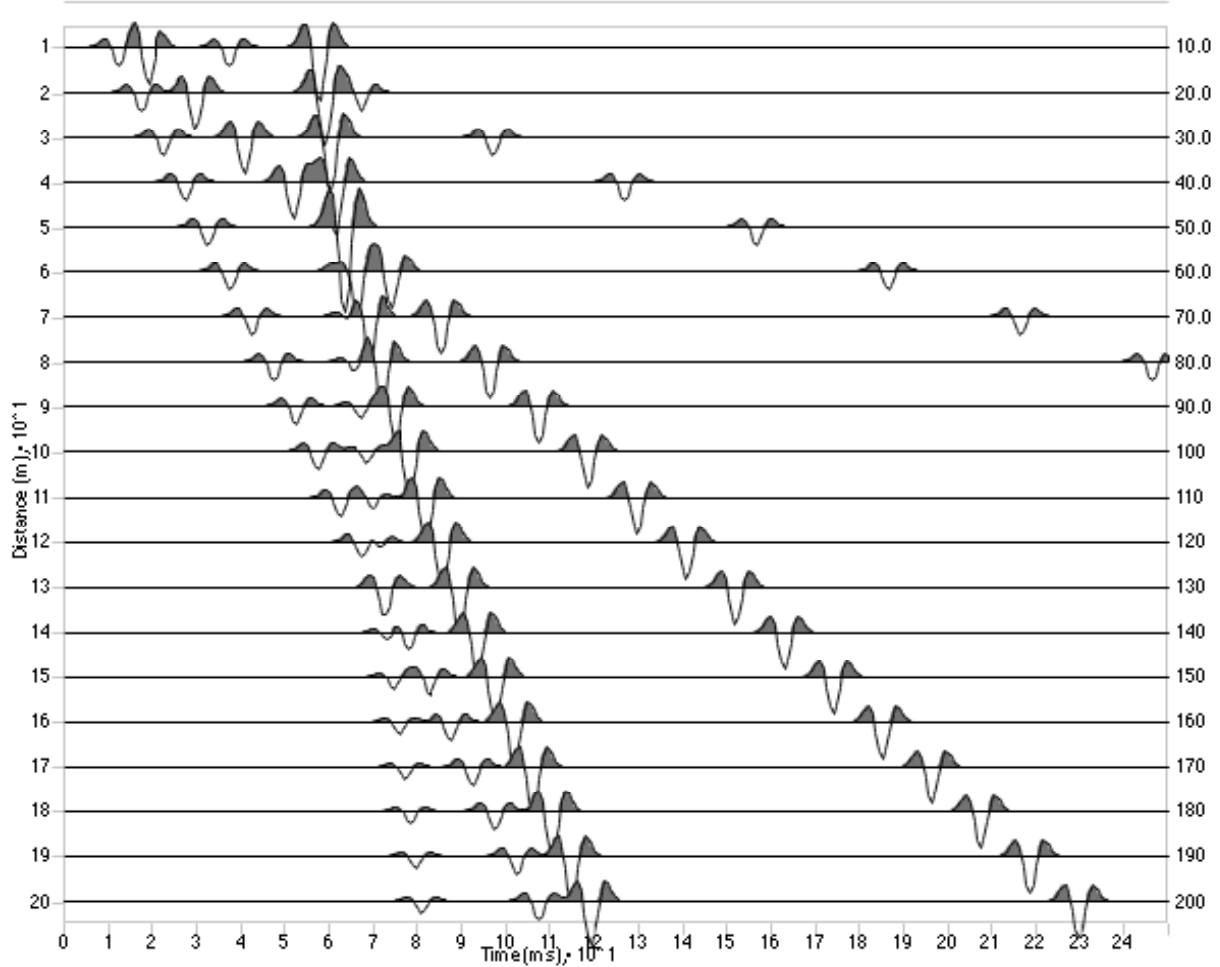
The fit shown is from this model:

Layer	Thickness (m)	Resistivity (ohm-m)
1	2.752692	512
2	9.330057	75
3	infinite	1007

A) Are there alternative models as likely or more likely? If so, how would you find them (what layers would you adjust, and in what manner)? If not, explain why not.

B) A refraction profile in the same area places bedrock at a depth of 5 m. Could there be an interface in the resistivity structure consistent with this depth? If so, what resistivity structure would you expect?

(5) (15 pts) Consider the shot gather shown below for a shot 10m from the first geophone. Distances from the shot are listed on the right.



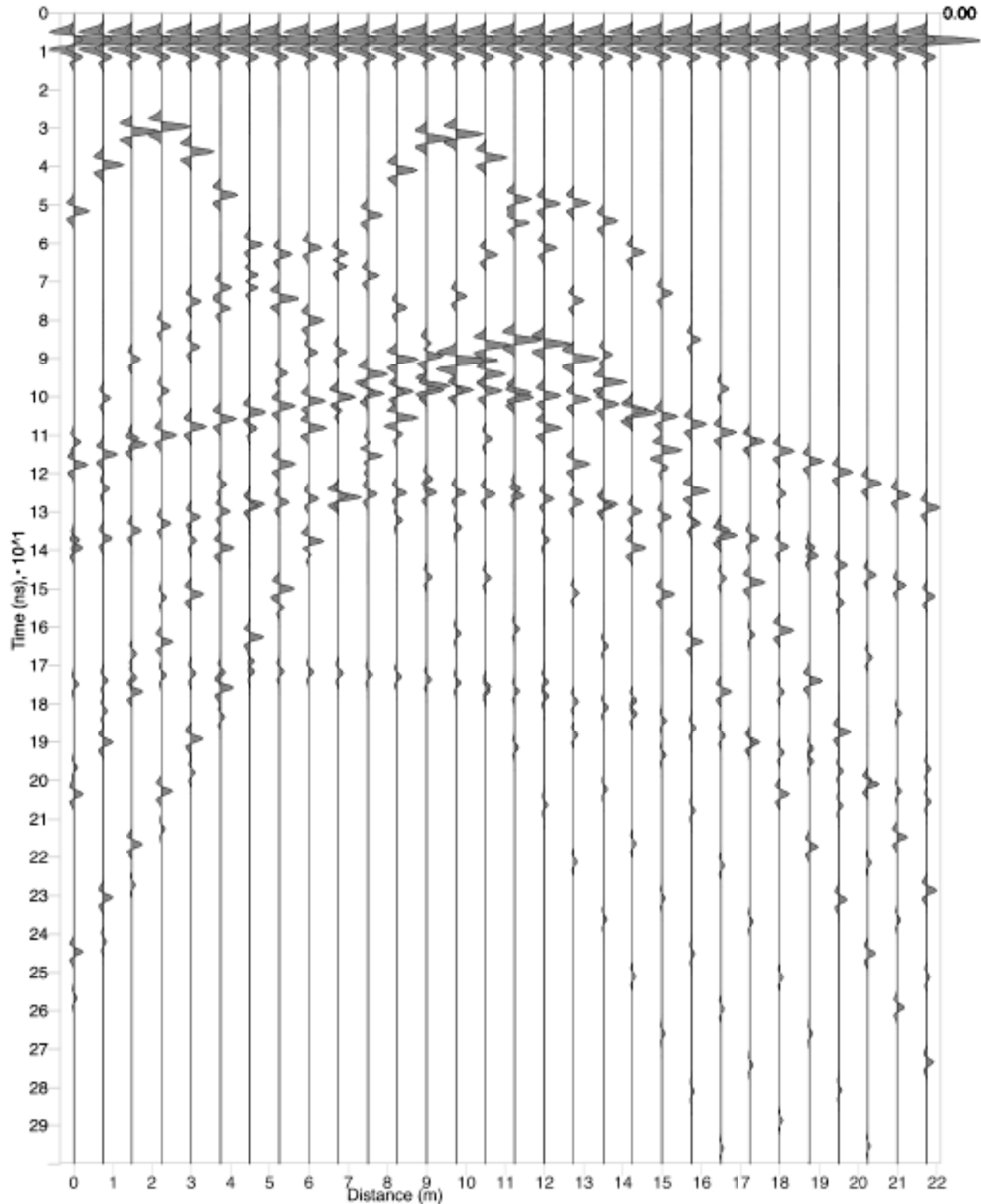
Model traces for direct, air, ground roll, first refracted, 1 reflected waves

- A) (5 points) Identify the reflected arrival (mark it clearly)

- B) (5 points) If you were to conduct a fixed-offset reflection profile seeking to image variations in the depth of the reflector, what offset would you choose and why?

- C) (5 points) Estimate the depth of the reflector under the shot. (Hint: there are two pieces of information you need to do this). Show intermediate results clearly.

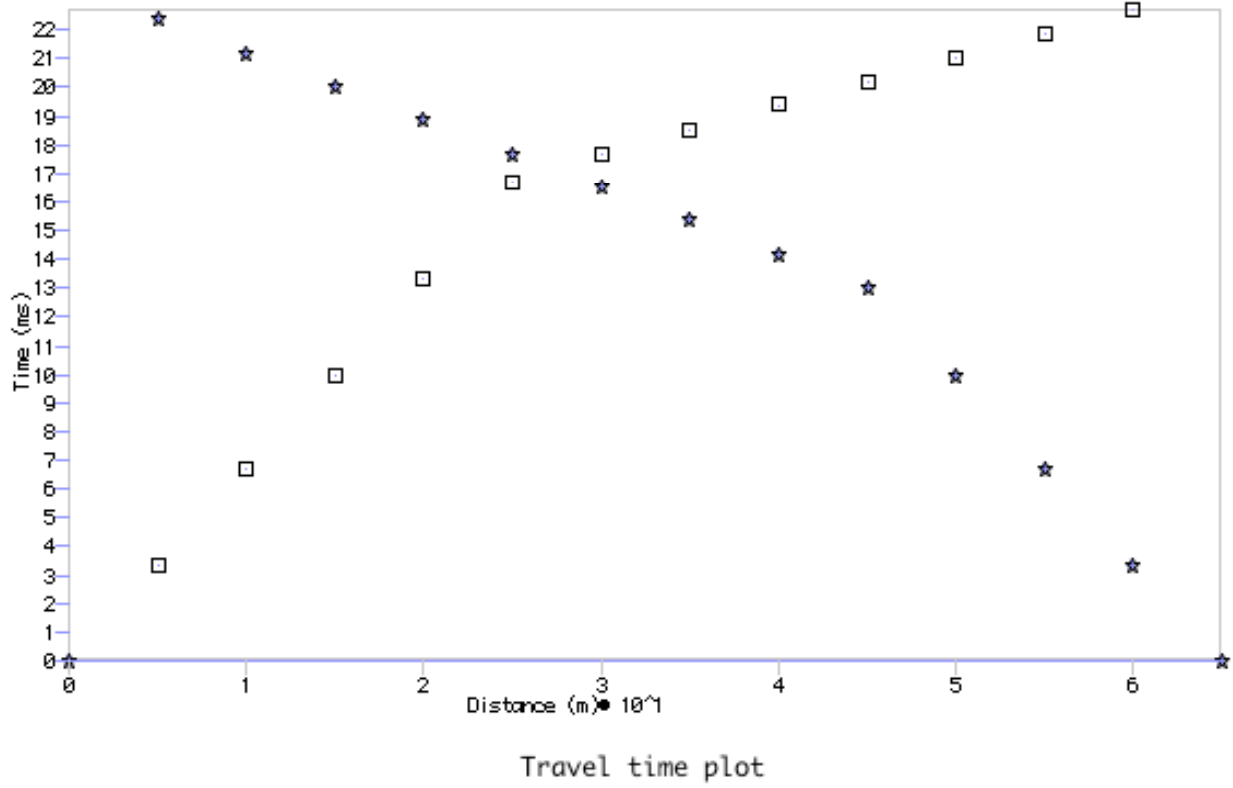
(6) (15 pts) A GPR profile is acquired in an area with glacial till overlying lake beds. The till contains boulders comparable to and larger than the wavelength of the GPR unit used. A colleague has interpreted these results to indicate that the till extends to a depth of at least 8.5 meters. Do you agree with this interpretation or not? If not, how would you modify the interpretation? Justify your answer.



(7) (10 pts) Below is a plot of arrival times picked for a reversed refraction profile (left is west). What are the apparent velocities of the refracted arrival (second layer) in the forward (west to east) direction _____

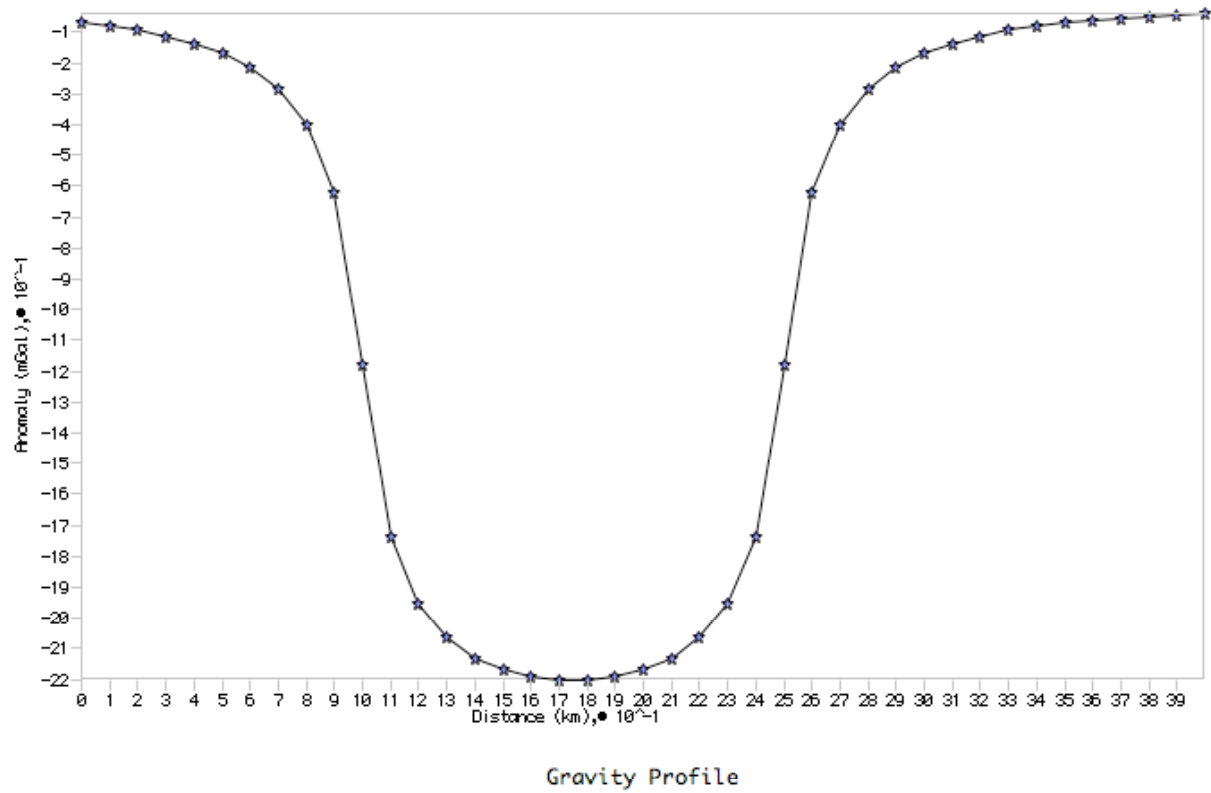
reversed direction _____

Which direction (if any) does the base of the top layer dip? _____



Describe a simple geologic scenario that might be consistent with these observations, indicating the basis for this interpretation.

(8) (5 pts) Consider the gravity profile below that was acquired over a sedimentary basin. One possible fit is to use an anomaly 0.2 g/cc less dense than the basement rock 300m thick with vertical walls on the basin margins at 1 and 2.5 km along the profile. Seismic refraction suggests a basin bottom at 100 m depth. Can this be reconciled with the gravity, and if so, how? How would you have to change the gravity model?



(9) (15 pts) New natural gas wells are to be drilled in eastern Boulder County near Louisville. The Louisville area was the site of extensive underground coal mining about 100 years ago to depths of several hundred meters. Records of the old mine workings have been lost or are incomplete. The drilling company wants very much to avoid drilling through any mine workings because hitting a void causes the drilling muds to drain and expensive measures must be undertaken to complete the hole (or it must be abandoned). If the company is hoping to drill holes roughly at the corners of a square 2 miles on a side, what sort of geophysical survey would you suggest? Keep in mind that reflection surveys are most expensive to conduct, followed by refraction, resistivity sounding, GPR, gravity, and magnetic surveys, which are the cheapest to acquire. Sketch the location(s) of any geophysical surveys on the sketch map.

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