UNIVERSITI SAINS MALAYSIA

First Semester Examination
2003/2004 Academic Session

September - October 2003

ZGE 373E/3 - Seismic Data Processing

Time : 3 hours

Please check that the examination paper consists of **SIX** printed pages before you commence this examination.

Answer <u>FOUR</u> questions only. Answer question 1, 2, 3 and either 4 or 5. Students are allowed to answer all questions in English OR Bahasa Malaysia OR a combination of both.

1. (a) Convolve (2, 1) with (3, 1, 0,-2, 0, 2).

(20/100)

(b) Transform the signal (4, 8, 3) into its minimum phase equivalent.

(20/100)

(c) Explain what it is meant by Nyquist Frequency.

(20/100)

(d) Explain precisely what it is meant when defining a filter slope as 60dB/octave.

(20/100)

(e) Explain precisely the exploding reflectors model.

(20/100)

2. (a) Fill the missing elements in the following table. You are required to state the equations for both average velocity and root-mean square (RMS) velocity.

Layer Thickness (m)	Interval Velocity (m/s)	RMS Velocity (m/s)	Average Velocity (m/s)
200	2000		
300	3000		
400	4000		
350	3500		
500	5000		

(60/100)

(b) The most common scheme in picking time values (t'_{ijh}) in residual static correction is a pilot trace scheme. Describe how this scheme is normally implemented.

(40/100)

3. Construct a prediction error filter to remove the echo from the signal S

S = (2, 1, 0, 0, 0, 1, 0.5, 0)

that occurs at a prediction distance of five samples. Convolve the result with the signal S.

(100/100)

4. (a) Explain the problem of circularity in processing the seismic data.

(20/100)

(b) Two digital signals with sample length of 100 and 250 samples respectively are to be convolved together using a frequency domain algorithm. Noting that the algorithm requires samples length to the power of 2, how many zeros should be added to the signals to avoid possible problem due to circularity?

(40/100)

(c) Explain precisely how you would construct a digital filter to perform wavelet deconvolution of seismic reflection data without prior knowledge of the source wavelet. State clearly any assumptions included in the method.

(40/100)

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5. (a) Using an appropriate diagram/s, describe the basic principles of migration.

(60/100)

(b) Measure the apparent dip (Δt / Δx) of the reflector on the zero-offset section in Figure 1, at point A_1, A_2, A_3. By using an appropriate equation, compute the horizontal and vertical displacement due to migration. Note that the trace spacing is 30 meters.
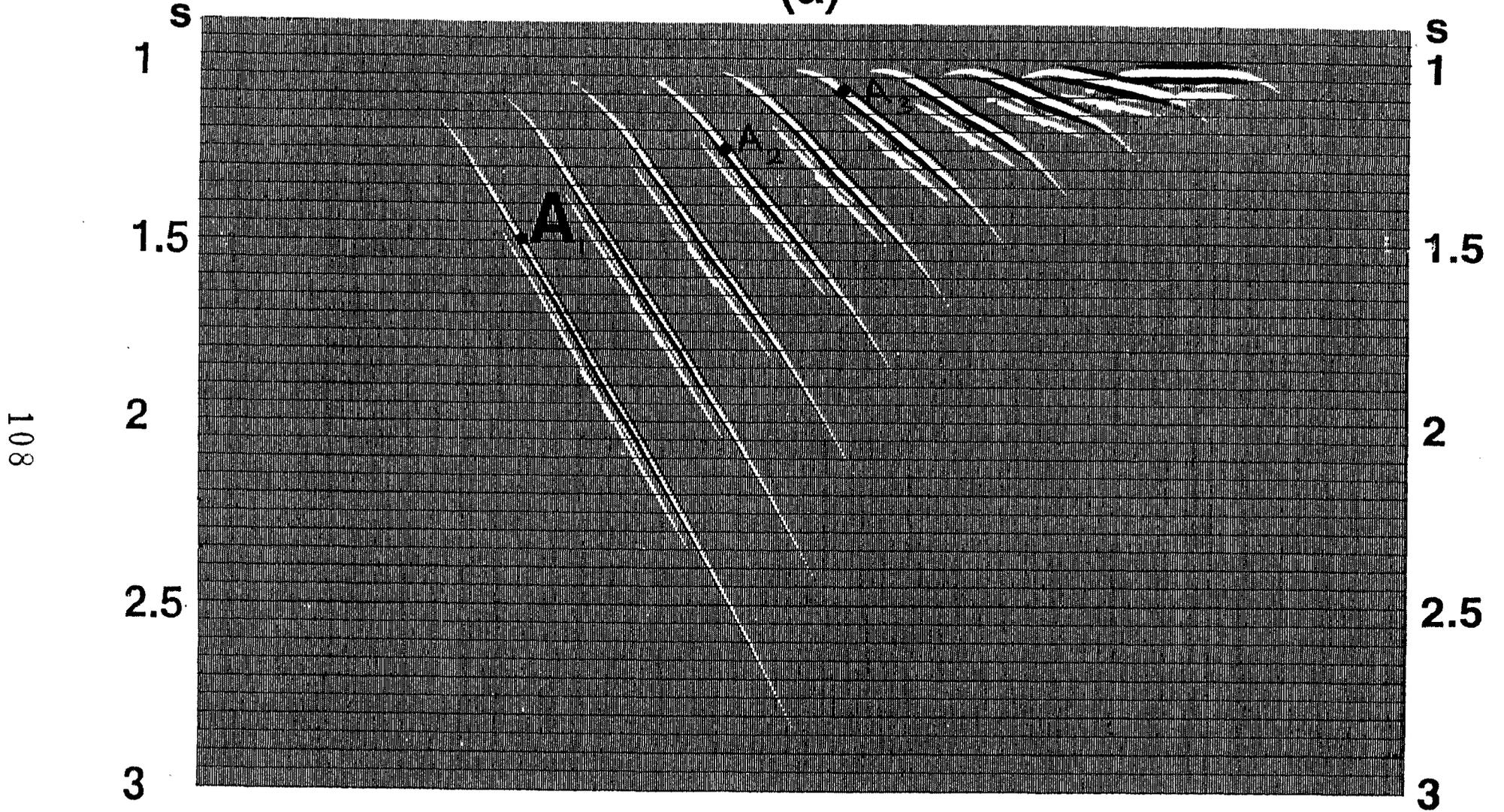
(40/100)
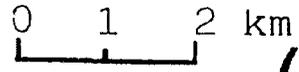
Figure 1. Zero-offset section with trace spacing of 30 m. Velocity for the reflector is assumed constant at 2800 m/s.