Solutions to selected problems in Chapter 1

1.1 State, with justifications, two major advantages and two major disadvantages of DSP compared with analog signal processing system design.

There are many important advantages and disadvantages of DSP compared to analogue signal processing. These are covered in detail in section 1.1 of the text. Major advantages include the ability to achieve guaranteed accuracy and perfect reproducibility; inherent flexibility (programmability – e.g. algorithms can be changed without having to modify the hardware); performance does not vary with environmental changes; ease of implementation (ability to implement with relative ease functions not possible with analogue signal processing e.g. linear phase filtering, complex adaptive filtering and other mathematical functions).

Important disadvantages include long design time (especially for new comers); the slow speed and high cost of high performance DSP devices (although these are coming down); the bottleneck at the analogue interface to the real world (ADC/DAC) and the associated irreducible errors.

1.2 Describe, with the aid of a block diagram, the audio reproduction process in the compact disc player. State and justify four advantages of using DSP techniques in this application.

The block diagram for the audio signal reproduction is given in Figure 1.14 of the main text. The advantages of using DSP are discussed in section 1.6.3, and include ability to use digital filters with linear phase response to avoid impairments to the sound quality, use of lower resolution DAC to achieve good SNR (14 bits in stead of 16 bits), simplifying the anti-imaging filter because of oversampling, making it cheaper and easier to match the filters used for the two stereo channels, use of a filter with a characteristic that varies with the clock rate, making it insensitive to the speed of the disc.