**1.a** When the telephone was originally marketed, two users could communicate to each other only if there was a wire that connected their respective homes. Within a year, the cities were covered with wires passing over houses and trees in a wild jumble. What solution was devised to fix this problem?

**1.b** In order to allow for long distance calls, there are five levels of hierarchy for telephone switching offices in the US. Why isn’t a single level of hierarchy enough?

**2.a** Suppose you want to transmit text messages over the Internet. You are using your computer at home, with a modem transmitting at 40 Kb/s. If each line of your text message has 50 characters (including spaces), how many lines per minute will you be able to send?

**2.b** You just bought a brand new digital video camera. The camera takes 30 frames per second, with 300 lines per frame and 200 pixels per line. Each color pixel is encoded with 12 bits. The video data is written on the camera’s memory, which holds 1GB. Unfortunately, your camera has no way to compress the video data. You begin shooting your first video; how long will it take till you fill up your camera’s memory?

**2.c** Given that you are unsatisfied with the amount of memory on your camera, you decide to connect the camera to an external hard drive, so that you can take longer shots. Would a USB 1.1 connection be suitable for this purpose?

**3.** The telephone transmits analog voice signals, but to transmit voice on the Internet, we need to digitize it first. For this purpose, you use an ADC with a sampling period of 1/8000 s, and 16 bits per sample. What is the bitrate (in Kb/s) generated by this system?