|  |  |
| --- | --- |
| *b* | ***H*** |
| 3 | 2.19 |
| 4 | 3.25 |
| 5 | 4.28 |
| 6 | 5.35 |

Can these specifcations be met? Justify your answer.

**Problem 6.29:** HDTV

As HDTV (high-Defnition television) was being developed, the FCC restricted this digital system to use in the same bandwidth (6 MHz) as its analog (AM) counterpart. HDTV video is sampled on a 1035 × 1840 raster at 30 images per second for each of the three colors. The least-acceptable picture received by television sets located at an analog station's broadcast perimeter has a signal-to-noise ratio of about 10 dB.

1. Using signal-to-noise ratio as the criterion, how many bits per sample must be used to guarantee that a high-quality picture, which achieves a signal-to-noise ratio of 20 dB, can be received by any HDTV set within the same broadcast region?
2. Assuming the digital television channel has the same characteristics as an analog one, how much compression must HDTV systems employ?

**Problem 6.30:** Digital Cellular Telephones

In designing a digital version of a wireless telephone, you must frst consider certain fundamentals. First of all, the quality of the received signal, as measured by the signal- to-noise ratio, must be at least as good as that provided by wireline telephones (30 dB) and the message bandwidth must be the same as wireline telephone. The signal-to- noise ratio of the allocated wirelss channel, which has a 5 kHz bandwidth, measured 100 meters from the tower is 70 dB. The desired range for a cell is 1 km. Can a digital cellphone system be designed according to these criteria?

**Problem 6.31**: Optimal Ethernet Random Access Protocols

Assume a population of *N* computers want to transmit information on a random access channel. The access algorithm works as follows.

* Before transmitting, fip a coin that has probability *p* of coming up heads
* If only one of the *N* computer's coins comes up heads, its transmission occurs successfully, and the others must wait until that transmission is complete and then resume the algorithm.
* If none or more than one head comes up, the *N* computers will either remain silent (no heads) or a collision will occur (more than one head). This unsuccessful transmission situation will be detected by all computers once the signals have