Example 3.1 If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) four-cell reuse, (b) seven-cell reuse, and (c) 12-cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems.

Solution Given: Total bandwidth = 33 MHz Channel bandwidth = 25 kHz × 2 simplex channels = 50 kHz/duplex channel Total available channels = 33,000/50 = 660 channels (a) For N = 4, total number of channels available per cell = 660/4 ≈ 165 channels. (b) For N = 7, total number of channels available per cell = 660/7 ≈ 95 channels. (c) For N = 12, total number of channels available per cell = 660/12 ≈ 55 channels. A 1 MHz spectrum for control channels implies that there are 1000/50 = 20 control channels out of the 660 channels available. To evenly distribute the control and voice channels, simply allocate the same number of voice channels in each cell wherever possible. Here, the 660 channels must be evenly distributed to each cell within the cluster. In practice, only the 640 voice channels would be allocated, since the control channels are allocated separately as 1 per cell. (a) For N = 4, we can have five control channels and 160 voice channels per cell. In practice, however, each cell only needs a single control channel (the control channels have a greater reuse distance than the voice channels). Thus, one control channel and 160 voice channels would be assigned to each cell. (b) For N = 7, four cells with three control channels and 92 voice channels, two cells with three control channels and 90 voice channels, and one cell with two control channels and 92 voice channels could be allocated. In practice, however, each cell would have one control channel, four cells would have 91 voice channels, and three cells would have 92 voice channels. (c) For N = 12, we can have eight cells with two control channels and 53 voice channels, and four cells with one control channel and 54 voice channels each. In an actual system, each cell would have one control channel, eight cells would have 53 voice channels, and four cells would have 54 voice channels