NET3900: Assignment 2

These questions are based on Module 2. Submit your answers via Bb by end-of-day Sept 21, 2016. Always show your calculation or provide explanation for your answers. The marks value for each question follows the question number.

Q1/2: How does OFDM improve transmission over traditional FDM?
Subcarriers are orthogonal which permit closer spacing. This results in higher channel efficiency and higher bandwidth.

Q2/2: Briefly explain how QAM is used to modulate a signal.
Two carriers (In Phase and Quad Phase) are amplitude modulated and summed together. The result is equivalent to a single carrier which is amplitude and phase modulation.

Q3/2: Answer the following questions for 1024 QAM.
a) How many constellation points?
b) How many bits per symbol are encoded?
c) How many In-Phase amplitude levels?
a) 1024
b) 10 (2^{10}=1024)
c) 32 (5 bits on In Phase carrier and 2^5=32)

Q4/2: A data stream has been FEC coding with a coding rate of 3/4. How many redundancy bits are added for every 12 data bits?
D = Data bits = 12, R=Redundancy bits, Total bits = D + R
R = D / D+R
therefore
3/4 = 12 / (12+R)
12+R = 12 * 4 / 3 = 16
R = 4.

Q5/1: The delay spread is measured to be 250 nsec. Which value of GI should be used?
GI has two values 400ns and 800ns.
GI should be 400ns which is long enough to address the delay spread of 250ns. The 800ns GI will unnecessarily decrease channel bandwidth

Q6/1: A Wi-Fi channel is 80 MHz. How many channels were bonded to achieve this?
Each channel is 20 MHz. Therefore 4 channels are required to create bonded channel of 80 MHz.

Q7/2: An Access Point is operating in the 5 GHz band with the following parameters: 802.11n radio, 2 Spatial Streams, FEC Coding Rate = 5/6, 64 QAM and long GI and 2 bonded channels. What is the PHY rate?
Given PHY rate = NBRS/(3.2+GI)usec
2 bonded channels therefore N = 108
B=6 bits per symbol (derived from 64 QAM)

R=5/6
S=2 spatial streams

PHY rate = $(108*6*5/6*2)/(4*10^{-6})$
PHY rate = 270 Mbps

Q8/2: The PHY Layer has two sublayers. Name them and describe their function?
PLCP - PHY Layer Convergence Procedure Sublayer: It takes the MAC Frame and creates a PPDU, that is, it adds PHY Layer header information such as PHY rate used by the transmitter.

PMD - Physical Medium Dependent Sublayer: It modulates and transmits the actual bits.