Question 2

- Explain how OFDM works, with the help of diagrams.

  > If a channel transmits only one-way signal is very wasteful, in order to be able to make full use of the bandwidth of the channel, the method of frequency division multiplexing can be used. The main idea of OFDM is that the channel is divided into several orthogonal sub-channels, and the high-speed data signals are converted into parallel low-speed sub-streams and modulated to be transmitted on each sub-channel. The orthogonal signals can be separated by using correlation techniques at the receiver side, which reduces the ISI between subchannels. The signal bandwidth on each subchannel is smaller than the correlation bandwidth of the channel, so it can be seen as flat fading on each subchannel, thus allowing inter-code crosstalk to be eliminated, and since the bandwidth of each subchannel is only a fraction of the original channel bandwidth, channel equalization becomes relatively easy.

- Describe the main features in the IEEE 802.11 ac proposal.

  > The new standard achieves much higher data rates than 802.11n by means of enhancements in three areas:
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  > - Bandwidth: The maximum bandwidth of 802.11n is 40 MHz; the maximum bandwidth of 802.11ac is 160 MHz.
  > - Signal encoding: 802.11n can use 64 QAM with OFDM, and 802.11ac can use 256 QAM with OFDM. Thus, more bits can be encoded per symbol. Both schemes use forward error correction with a code rate of 5/6.
  > - MIMO: With 802.11n, there can be a maximum of 4 channel input and 4 channel output antennas. 802.11ac increases this to 8 * 8.

- Explain how the WLAN security is improved in WPA2.

  > Authentication & Integrity：
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  > - Key management and message integrity is handled by a single component built around AES
  > - Using a CBC-MAC (Cipher Block Chaining Message Authentication Code)
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  > Encryption
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  > - Uses CTR (Counter mode) AES (128 bit)
  > - Computationally expensive and adds a significant amount of overhead
  > - Use CCMP (Counter Mode with Cipher Block Chaining Message Authentication Code Protocol) instead of TKIP

- Explain the network topology in Bluetooth 2.0.

  > The basic unit of networking in Bluetooth is a piconet, consisting of a master and from one to seven active slave devices.
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  > The radio designated as the master makes the determination of the channel (frequency-hopping sequence) and phase (timing offset, i.e., when to transmit) that shall be used by all devices on this piconet.

> - The radio designated as a master makes this determination using its own device address as a parameter, while the slave devices must tune to the same channel and phase.
> - A slave may only communicate with the master and may only communicate when granted permission by the master.
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> A device in one piconet may also exist as part of another piconet and may function as either a slave or master in each piconet. This form of overlapping is called a scatternet.