1. **Is the 3G wireless service available in Taiwan? How is it priced? What applications are being supported?**

   Yes.

   There are two of charging models: (i) one is based on traffic, and (ii) another one is unlimited, which may be more expensive.

   3G network can be used for IPoV, voice call, and surfing the Internet.

2. **Suppose that the receiver in Figure 1 wants to receive the data being sent by sender 2. Demonstrate (in math) that the receiver is indeed able to recover sender 2's data from the aggregate channel signal by using sender 2's code.**

$$d_0^2 = \frac{2\times1 + 0\times(-1) + 2\times1 + 0\times1 + 2\times1 + (-2)\times(-1) + 0\times1 + 0\times1}{8} = 1$$

$$d_1^2 = \frac{0\times1 + (-2)\times(-1) + 0\times1 + 2\times1 + 0\times1 + 0\times(-1) + 2\times1 + 2\times1}{8} = 1$$

3. **Suppose an 802.11b station is configured to always reserve the channel with the RTS/CTS sequence. Suppose this station suddenly wants to transmit 1,000 bytes of data, and all other stations are idle at this time. As a function of SIFS and DIFS, and ignoring propagation delay and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgment.**

   Assume that bandwidth is *b* bps, RTS frame is *r* bytes, CTS frame is *c* bytes and ACK frame is *a* bytes.

   Total time = DIFS + $\frac{8r}{b}$ + SIFS + $\frac{8c}{b}$ + SIFS + $\frac{1000*8}{b}$ + SIFS + $\frac{8a}{b}$ second.

4.

   a、 **Suppose now that an omniscient controller (i.e., a controller that knows the state of every node in the network) can command each node to do whatever it (the omniscient controller) wishes, i.e., to send a message, to receive a message, or to remain silent. Given this omniscient controller, what is the maximum rate at which a data message can be transferred from C to A, given that there are no other messages between any other source/destination pairs?**

   First time slot : sent a message from C to B, other nodes silent

   Second time slot : pass a message from B to A, other nodes silent.

   Maximum rate = 1 messages / 2 slots = 0.5.

   b、 **Suppose now that A sends messages to B, and D sends messages to C. What is the combined maximum rate at which data messages can flow from A to B and from D to C?**

   First time slot : sent a message from A to B and from D to C.

Maximum rate = 2 messages / 1 slot = 1.

c、 Suppose now that A sends messages to B, and C sends messages to D. What is the combined maximum rate at which data messages can flow from A to B and from C to D?

First time slot : sent a message from C to D, other nodes silent.

Second time slot : sent a message from A to B, other nodes silent.

Maximum rate = 2 messages / 2 slots = 1.

d、 Suppose now that the wireless links are replaced by wired links. Repeat questions (a) through (c) again in this wired scenario.

Assume that each pairs is connected.

(a) First time slot : sent a message from C to A, other nodes silent.
Maximum rate = 1 message / 1 slot = 1.

(b) First time slot : sent a message from A to B and from D to C.
Maximum rate = 2 messages / 1 slot = 2.

(c) First time slot : sent a message from A to B and from C to D.
Maximum rate = 2 messages / 1 slot = 2.

e. Now suppose we are again in the wireless scenario, and that for every data message sent from source to destination, the destination will send an ACK message back to the source (e.g., as in TCP). Also suppose that each ACK message take up one slot. Repeat questions (a) (c) above for this scenario.

(a) First time slot : sent a message from C to B, other nodes silent.
Second time slot : pass a message from B to A, other nodes silent.
Third time slot : sent a ACK from A to B, other nodes silent.
Fourth time slot : pass ACK from B to C, other nodes silent.
Maximum rate = 1 message / 4 slots = 0.25.

(c) First time slot : sent a message from C to D, other nodes silent.
Second time slot : sent a message from A to B, sent ACK from D to C.
Third time slot : sent ACK from B to C, other nodes silent.

Maximum rate = 2 messages / 3 slots = $\frac{2}{3}$.