Overview of Wireless Networks (Chapter1)
1、 **Answer**: 1831 Electromagnetic induction:
5radio; 1906 AM; 1981 NMT; 1988 GSM;
2、 **Answer**: Cellular system: mobile management; mobile IP; Wi-Fi; WiMax; ad hoc; wireless network safety; unlimited personal LAN; sensor network; Software defined networking;

Radio propagation (Chapter 2)
1、 **Answer**: wireless media doesn't need fiber-optical, electrical line. while wired media needs; wireless media is unset while the wired one is table.
2、 **Answer**: license one is stable but limited; unlicensed one is free.
3、 **Answer**: Reflection: when the blocker's size is much bigger than the wavelength, reflection occurs; Diffraction: when the wave is locked by something shape, the diffraction occur; Scatting: when the blocker's size is comparable with the wavelength, the scatting occurs.
4、 **Answer**: Indoor: reflection on the wall, scatting, diffraction. Outdoor: the reflect on the building; diffraction on the roof; the reflection on the road.
5、 **Answer**:
$$L = \frac{G_t G_r P_t}{P_r} \cdot \frac{P_r}{P_t} = \frac{G_t G_r}{L} \cdot \frac{h_b^2 h_m^2}{d}$$

6、 **Answer**:
$$L_{p(d)} = \begin{cases} A + B\lg d & city \\ A + B\lg d - C & urban \\ A + B\lg d - D & open \end{cases}$$
$$A = 69.55 + 26.16 \lg f_c - 13.82 \lg h_b - a(h_m)$$
$$B = 44.9 - 6.55 \lg h_b \quad C = 5.4 + 2[\lg (f_c/28)]^2$$

7、 **Answer**: Shadowing falling: the long range chang in the average level. Slow falling: because of the blocker, the signal strength falls with the distance increasing.
8、 **Answer**: $L_p = L_0 + 10^2 \lg D + X$.
9、 **Answer**:
$$L_{p(d)} = \begin{cases} A + B\lg d & city \\ A + B\lg d - C & urban \\ A + B\lg d - D & open \end{cases}$$
$$A = 69.55 + 26.16 \lg f_c - 13.82 \lg h_b - a(h_m)$$
$$B = 44.9 - 6.55 \lg h_b \quad C = 5.4 + 2[\lg (f_c/28)]^2$$

10、 Multipath fading: the signal corrupt after passing through different path. Small-scale falling: the received signal strength change rapidly in short time or short distance. Doppler shift: when the transmitter moves toward or back toward to the receiver, the receiver signal frequency change.

spectnem: $f_{ray}(r) = \frac{r}{\sigma^2} \cdot \exp\left(\frac{-r^2}{2\sigma^2}\right) \cdot r \geq 0$, multipath

$V(t) = \frac{Vf}{c} \cdot \cos\theta(t)$ doppler shift

11、 **Answer**:

ray lentgh

Ricean.
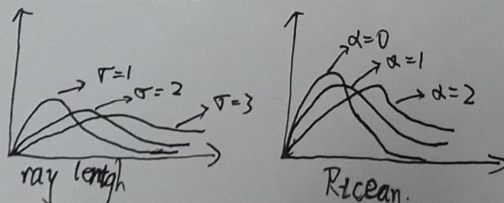
12、 **Answer**: $V(t) = \frac{Vf}{c} \cdot \cos\theta(t)$

13、 **Answer**: $f_{ray}(r) = \frac{r}{\sigma^2} \cdot \exp\left(-\frac{r^2}{2\sigma^2}\right), r \geq 0$, reyleigh

$f_{ric}(r) = \frac{r}{\sigma^2} \cdot \exp\left(\frac{-(r^2+\alpha^2)}{2\sigma^2}\right) I_0\left(\frac{\alpha r}{\sigma^2}\right), r \geq 0, \alpha \geq 0$.

Cellular system (chapter 3 and chapter 4)
1、 **Answer**: 1996-1997, 2G appear, 2008, China TD-SCDMA, aropean WCDMA, America XCDMA 2000, 3G.
2、 **Answer**: K=JN
3、 **Answer**: C=MJN
4、 **Answer**: $N = i^2 + ij + j^2$
5、 **Answer**: base station: the station which produce signal. Up link: connect to the cells. Cells: the receiver. Location areas: the area that receiver locating in mobile switching centers: the center of location area. VLR: record the visitor. HLR: record the station. To make communication more stable. High speed, more stable, wider scale. TDMA in 2G, CDMA in 3G is used to more signal in one time. The difference is one is time division and code division.
6、 **Answer**: SGSN: serving GRRs support Node. GGSN: Gateway GRRS support node.
7、 **Answer**: W-CDMA, CDMA, TD-SCDMA, WiMAX.
8、 **Answer**: fast, widely-used, stable.
9、 **Answer**: 3Mb/s, 320Kb/s, 2.5GHz.
10、 **Answer**: surfing the internet, telephone business, video meeting, telephone TV, wireless search.

Future Technologies(Chapter 5)
1、 **Answer**: Mobile Cloud Computing, Mobile Web Pages, Mobile access, Pervasive Computing

Mobility Management(Chapter 6)
1、 **Answer**: Determine the appropriate threshold of signal strength to hand-off; Determine whether to do quick hand-off according to the speed of mobile station; Find the new base station that can give stronger signal; Build connection with new base station; Cut off connection with the original station
2、 **Answer**: intra-switch hand-off happens in one MSC(Mobile switching center), inter-switch hand-off happens between two MSC.
3、 **Answer**: MCHO: Mobile Controlled Hand-off NCHO: Network Controlled Hand-off MAHO: Mobile Assisted Hand-off
4、 **Answer**:Hard hand-offs: adv: don't need to change channel disadv: communication should be cut off temporarily. Soft hand-offs: adv: communication can be maintained. disadv: will take up more channel resources
5、 **Answer**: Mobile devices detect signal strength from base station automatically, and feedback to base station.
6、 **Answer**: Straight-line: linear function

model. Fluid flow: A model used to describe fluid flowing in container.

7、Answer: If MSC found that signal strength from a mobile station is decreasing, and meanwhile there is no cell in this MSC that has a stronger signal, then inter-switch handoff should be happened,

8、Answer: If a cell split to several smaller cells, though system capacity and transmit power can be improved，the handoff will be carried out more frequently.

9、Answer: It consists of cellular network and WLAN(Wireless Local Area Networks).

10、Answer: location update: when the coding detected is different from last time, location should be updated，it consists of 2 steps: Authentication and database update. Service delivery: (Mobile devices initialization; give a call; call delivery; Receive call; keep call; handoff when cell change;) or (database checking; terminal call delivery)

11、Answer: time-based: detect location at regular time, it's easy to manage but doesn't work when users move fast;
movement-based: detect location based on users movement. It's flexible .When users are static, detect frequency can be decreased.
distance-based: accurate but need more resources.

Mobile IP(Chapter 7)

1、Answer: A permanent IP address allow me to have a fixed IP address when a node change link.

2、Answer: MN: Mobile Node. HA: Home Agent. FA: Foreign Agent. COA: Care-of Address. CN: Communication Node.

3、Answer: with: HA Intercept data, and encapsulate data using reverse tunneling, then send to CoA Without: HA send data to MN directly.

4、Answer: Mobile node initiates registration when link change. Then Mobile node broadcast to home network for registration. After that, Foreign agent will generate a Care-of Address and notice the home agent.

5、Answer: When errors take place in a registration, die out automatically and then re-register can correct the errors.

6、Answer: Noise too loud or be refused by agent.

7、Answer: IP in IP encapsulation: the whole IP data pack be encapsulated directly. Minimum encapsulation: new IP head be inserted between original IP head and IP load. General routing encapsulation: data for a protocol be encapsulated in data for another protocol.

8、Answer: Reverse tunneling is a data encapsulation technology. By this technology, the original IP package would be encapsulated in data payload of another data package. IP address would be grouped and encapsulated respectively at the beginning of tunneling, and would be split at the end of tunneling.

IEEE 802.11 WLAN (Chapter 8)

1、Answer: DCF: Distributed coordination function PCF: Point coordination function DIFS: DCF Inter-frame Spacing SIFS: Short inter-frame space PIFS: PCF Inter-frame Space.

2、Answer: 802.11e :a standard that defined quality-of-service of Wireless Local Area Networks. EDCA: Enhanced Distributed Channel Access. HCF: Hybrid Coordination Function.

3、Answer: ad-hoc: no center, Self-organized, Multi-hop routing, Dynamic topology. Only contains STA. Infrastructure: contains STA and AP;

4、Answer: LLC:Logic Link Control. MAC: Media Access Control. PLCP: Physical Layer Convergence Protocol. PMD: Physical Media Dependent

5、Answer: Infrared transmission uses IR diodes, diffuse light, multiple reflections. It's simple, cheap, available in many mobile devices, simple shielding possible, need no licenses. Radio typically using the license free ISM band at 2.4GHz, which covers larger areas than infrared transmission.

6、Answer: 802.11 in the physical layer defines the signal transmission signal characteristics and modulation methods, the definition of the two radio frequency transmission and an infrared transmission mode. 802.11a uses OFDM technology to modulate. 802.11b uses DSSS to modulate. 802.11g not only uses OFDM modulation, while retaining the DSSS modulation.

7、Answer: There are 8 priorities from 0 to 7 which guarantee the Qos.

8、Answer: DCF,PCF

9、Answer: With multicasting, the leg of the data path from the wireless client to the access point includes transmission error recovery. But multicast does not have ack packets and so there is no retransmission of lost packets.

10、Answer: Because this information is used by all other stations to set their NAV, and determine the waiting time.

11、Answer: Qos is supported in both infrastructure and ad hoc mode by classifying, marking, queueing, and scheduling.

12、Answer: To get the correct information from the other stations.

13、Answer: By TSF. In BSS, the AP sends the TSF information in the beacons. In Independent Basic Service Set (IBSS, ad-hoc), each station competes to send the beacon.

14、Answer: To enhance the network lifetime, and make sure that we power off during idle periods and yet maintain an active session.

15、Answer: In infrastructure mode it allows

idle to go to sleep, AP buffers packets for sleeping nodes, power saving stations wake up periodically.

16、 **Answer:** DTIM determine the time when multicast frames are to be delivered by AP, determined by AP. ATIM is the time when other stations announce if they have buffered packets for a sleeping station.

17、 **Answer:** The MAC header contains four address fields, each containing different addresses in different cases. The principle is that address 1 for the receiving address, address 2 for the sender address, address 3 auxiliary and address 4 for the wireless bridge or MeshBss network.

18、 **Answer:** 802.11a is an IEEE wireless network standard. Its transmission technique is multi-carrier modulation technology. Because 802.11a uses the 5.2Ghz frequency spectrum, it cannot interoperate with 802.11b or the 802.11 standard.

19、 **Answer:** The goal of WEP is that the security of the wireless LAN is comparable to the limited LAN.

20、 **Answer:** For the WEP itself doesn't have problem, but the problem is that the key itself is easily intercepted. For the MAC filter, the disadvantage is that if you set up your router to use a white list, you must modify the white list any time you purchase a new computer or mobile device. For the captive portal, it is simple.

21、 **Answer:** During an active scan, the client radio transmits a probe request and listens for a probe response from an AP. Another limitation with a passive scan is that if the client does not wait long enough on a channel, then the client may miss an AP beacon.

22、 **Answer:** When the media is idle, high-priority data is waiting less time. In order to maintain the inter operability of different data transmission rates, the time values of frame intervals are fixed, regardless of transmission rate.

WiMax (Chapter 9)

1、 **Answer:** WiMAX is an emerging broadband wireless access technology that provides high-speed connectivity to the Internet, with data distances up to 50km. WiMAX also has the advantages of QoS guarantee, high transmission rate, rich business and so on.

2、 **Answer:** It specified a physical layer operating in the 10 to 66 GHz range and using scalable orthogonal frequency-division multiple access(SOFDMA), and having multiple antenna support through MIMO.

3、 **Answer:** OFDM is based on the concept of frequency-division multiplexing (FDD), the method of transmitting multiple data streams over a common broadband medium. That medium could be radio spectrum, coax cable, twisted pair, or fiber-optic cable.

Ad Hoc Networks (chapter 10)

1、 **Answer:** Infrastructure requires a fixed central control, self-organizing ability is poor, the topology is a general traditional topology. Adhoc does not need the central node, can achieve self-access network, the topology is dynamic.

2、 **Answer:** Protocol interference model has been widely used to obtain radio interference information. The range is defined as a circle centered on a transmitter node, and the relationship is defined according to the location of the receiver node.

3、 **Answer:** Zone around each receiver to lead a high transmission capacity in ad hoc network.

Security(Chapter 11)

1、 **Answer:** WEP has two mechanisms ---- Encryption mechanism：The core algorithm is RC4 sequence secret code's algorithm. ---- Certification mechanism：WEP has used the Shared Key Certification Way. So the working schedule of WEP protocol is that certification mechanism and encryption mechanism working together.

2、 **Answer：** (1).Applicants send EAPOL Start frame to Certifiers for starting certification process. (2).Certifiers send the request. (3).Applicants response the request. (4).The RADIUS server verifies the legitimacy of the applicant's identity. (5).The RADIUS server verifies the legitimacy of the applicant's identity. (6).RADIUS informs the certifier of the authentication result. (7).The certifier sends the authentication result to the applicant.

3、 **Answer:** WEP encryption mechanism uses the RC sequence cipher algorithm, WAPI is unicast key negotiation and multicast key notification, IEEE 802.11i uses TKIP encryption mechanism.

Bluetooth and RFID(Chapter 12)

1、 **Answer**: Increasing the transmission distance and reducing energy consumption.

2、 **Answer:** Active state、Sniff state、Hold state and Park state.

3、 **Answer:** Reader：Be mainly responsible for two-way communication with the electronic tag, while receiving control commands from the host system. Electronic tags：The electronic tag consists of an IC chip and a wireless communication antenna. The built-in RF antenna is used to communicate with the reader.

4、 **Answer:** Chip technology、Antenna Design Technology 、 Packaging technology 、 Tag application technology、Standard research problem technology 、 RFID anti-collision technology.

5、 **Answer:** Logistics field、retail field、manufacturing industry field and so on.

Wireless Sensor Network (Chapter 13)

1、**Answer**: WSNs（sensor networks（Contains sensor nodes ）——>base station——>monitoring station）

2、**Answer**: Sensor node elements include the following features: Easy installation, self-identification, self-diagnosis, reliability, inter-node time synchronization, software functions and digital signal processing, standard communication protocol and network interface.

3、**Answer**: Mobile: environmental and agricultural applications: Duck Island biological environment monitoring system; military applications: intelligent dust.
Fixed: medical and health applications: remote health monitoring; environmental and agricultural applications: automatic sprinkler system.

4、**Answer**: Aircraft sowing sensor nodes, Place the sensor nodes in the room.

5、**Answer**: The latest MICA2 can operate at 868/916/433 and 315MHz 3 bands with a data rate of 40kb/s and a communication range of up to 1000 feet.

Internet of Things(Chapter 14)

1、**Answer**: ultra wideband、software radio、radio frequency identification and low power bluetooth wireless technology.

2、**Answer**: Good security, high processing speed, high transmission rate, large system capacity, strong anti-jamming performance, low power consumption, accurate positioning, easy to multi-functional integration, low cost.

3、**Answer**: Low-power Bluetooth uses two ways: single-mode and dual-mode form to improve the data transfer rate, reducing power consumption.

4、**Answer**: Cognitive radios can capture or perceive information from the work environment to identify unused spectrum resources in a particular time and space and select the most appropriate spectrum and operating parameters. It can also be dynamically programmed according to the wireless environment, allowing the device to use different wireless transmission technology to send and receive data.

5、**Answer**: Features: the use of information technology, the human body as a medium. Applications: Healthcare, wireless access / identification systems, navigation and positioning services, personal multimedia entertainment, military and space applications.

Software-Defined Networking (Chapter 15)

1、**Answer**: SDN is a programmable network architecture.

2、**Answer**: SDN through the standardization of centralized management and programmable network, the traditional network equipment tightly coupled network architecture into a bottom-up application layer, control layer, hardware exchange layer,

at the top of the user can customize the application to trigger the network In the definition.

3、**Answer**: SDN separates the network control from the physical network topology, and gets rid of the hardware restriction on the network architecture. Saving costs, reducing the iterative cycle of the network architecture, making the network more flexible.

Intelligent Robots, Cars and Quadrotors(Chapter 16,17 and 18)

1、**Answer**: Motor, camera, navigator, microphone, sonar rangefinder, infrared receiver, touch sensor and pressure sensor, Wi-Fi and Ethernet support.

2、**Answer**: Intelligent home, automatic driving, environmental monitoring, rescue with no people.

MIMO(Chapter 19)

1、**Answer**: There is only one transmission path between the transmitter and the receiver of the SISO system, while there are multiple transmission paths in MIMO system.

2、**Answer**: The channel model of the MIMO time domain is the convolution of the received signal y (t), the transmitted signal x (t) and the channel impulse response h(t):
$$y(t) = x(t) \otimes h(t) = \int x(\tau)h(t-\tau)d\tau .$$

3、**Answer**: The spatial diversity of the transmitter to the data stream encoding, so that there is a specific relationship between the codeword. Spatial multiplexing is the transmission of the data flow is divided into multiple sub-data streams, and from different antennas to launch, through the reuse of technology, without increasing the bandwidth in the case of doubling the data transfer rate.

4、**Answer**: Distributed MIMO, virtual MIMO, multiuser MIMO, networked MIMO.

Distributed MIMO: It consists of two parts: the central processor and the remote antenna unit. The combination of this system structure and the multi-antenna characteristics of MIMO technology constitutes a distributed MIMO.

Bitcoin and Graphic Code (Chapter 21 and 22)

1、**Answer**: The security of the bitcover in terms of value, its value fluctuates greatly; accounts, the lost wallet if no one picks up will not be able to recover, and the wallet is also facing the risk of theft; the transaction process, each transaction will Into the chain of the chain, so the transaction process security; transaction both sides of the privacy side, by the public key of A to know the transaction with the B's identity is very difficult.

2、**Answer**: The QR code uses the digital, alphanumeric, byte (binary) and Chinese characters in the normalized coding mode.