Chapter1

Question1: 1831 electromagnetic induction. 1876Bale,Phone.1988GSM.

Question2: Cellular system, WIFI,Wimax,bluetooth, R-FID,IOT,

Chapter2

Question1: Wired:visible,like cable.Wireless:invisible, air.

Question2: Licensed:5GHz WLAN,28 to 60GHz LMDS. Unlicensed band: ISM,U-NII.

Question3: Frequency, distance, the velocity of observer or signal source

Question4: Reflection: λsmaller than the obstacles. Diffraction: signal obstructed by obstacles having acute boundary. Scattering:obstacles is smaller than λ,light sources seem grow. Transmission: applying the previous three mechanism.

Question5: Indoor: Within transmission range, mainly affected by reflection and diffraction. Beyond the range, scattering appears. Outdoors: Affected by reflection from buildings and ground, by diffraction from roof, and by LOS path.

Question6: $\frac{P_t}{P_r} = G_t G_d \frac{h_b{}^2 h_m{}^2}{d^4}$

Question7: Two-ray modeling: Pass loss is $-\alpha lg(d)$, receiving power is $P_r = P_0 d^{-\alpha}$, transmission delays are (x+x' - l)/c.

Free space modeling: $L_P[dB] = 32.45 + 20lg f_c[MHz] + 20lg[km]$, receiving power is $P_r = \frac{G_t G_r P_t}{L}$,transmission delays are (x+x' - l)/c.

Question8: Slow fading: change relatively slow,caused by shadow, distant signal will be weak.

Question9: only know it is design allowance that provides for sufficient system gain or sensitivity to accommodate expected fading.

Question10: Macrocell: PL[db] = $(44.9 - 6.55log_{10}h_{bs})\frac{d}{100} + 45.5 + (35.46 - 1.1h_{ms})log_{10}(f_c) - 13.82log_{10}(h_{bs}) + 0.7H_{bs} + C$

Microcell: PL[db] = $-55.9 + 38 * log_{10}(d) + (24.5 + 1.5 * f_c/925) * log_{10}(f_c)$

Question11: Small-scale fading consists of multipath fading and Doppler shift. Multipath: different path, different distance, different phase. Doppler shift: relative motion, change of wavelength.

Question12: Rayleigh distributions: amplitude and phase is statistical independence. Ricean distributions: amplitude subjects to Gaussian distribution.

Quesiton13: Doppler shift: relative motion, change of wavelength.f'=f+v(t) $v(t) = \frac{Vf}{c} \cos \theta(t)$

Question14: have no idea

Question15: LCR = $\sqrt{2\pi} f_d \rho e^{-\rho^2}$, $AFD = \frac{1}{LCR}$

Chapter3 & 4

Question1: CDMA, data rate, media data transmitting

Question2: C=MJN, q=$\sqrt{3N}$, $P_{e(dBW)} = P_{0(dBW)} - 10klg\frac{d}{d_0}, d > d_0$

Question3: $q = \sqrt{3N} = (N_I \times \frac{S}{I})^{1/k}$

Question4: Base stations: fixed location, relays information. Downlink: satellite down to more ground stations.Uplink: ground station up to a satellite.Cells:area covered by cellular telephone transmitter. Location areas: the areas cells locate. MSC: centerpiece of a network switching subsystem.

Question5: HLR: store the details such as ID or billing detail.VLR:it provides a local database for the subscribers wherever they are physically located within a PLMN.

Question6: Handoff:let mobile nodes keep connection active when it moves from one access point to another. Location:enables networks to track the locations of mobile nodes.

Question7: Data rate, media transmission, improvement of stability

Question8: TDMA:digital modulation,limited system capacity. CDMA: greater capacity, greater quality of communication.

Question9: SGSN/GGSN: Packet routing and transfer, mobility management.

MSC/GMSC/HLR: makes it possible to cross-connect circuit switched calls switched by using IP, ATM AAL2 as well as TDM.

Question10: WCDMA,CDMA2000,TD-CDMA

Question11: CDMA,global communication.

Question12: 2.5G: transmission rate 150Kbps, bandwidth 1.6Mhz, operation frequency 450MHz.

Question13: FDMA:Advanced Mobile Phone Systems,CT2 Cordless Telephone and Digital European Cordless Telephone. TDMA:Global System for Mobile,U.S. Digital Cellular and Japanese Digital Cellular. CDMA:U.S. Narrowband Spread Spectrum (IS-95)

Question14: Combines ISB and DSB architectures to facilitate the integration of wireless LAN and3G cellular networks towards a uniform architecture for all-IP wireless networks.

Chapter5

Question1: Millimeter wave, D2D, MMIMO

Chapter6

Question1: initialization and operation of calling of mobile terminals, paging, acception of calls, continue to call, hand-off.

Question2: Both are hard hand off.intra-cell:to change a channel, which may be interfered, or fading with a new clearer or less fading channel.inter-cell:to maintain the call as the subscriber is moving out of the area of the source cell and entering the area of the target cell.

Question3: MCHO:Mobile-Controlled Hand-Off. NCHO:Network-Controlled Hand-Off.MAHO:Mobile-Assistant Hand-Off.

Question4: Hard:break before make. Soft: make before break thus won't confront glitch.

Quesiton5: Mobile nodes will automatically sensor the signal from BS and sends the results to BS the nodes subordinate to. While the specific difference of signal strength last longer the specific time, handoff process will begin.

Question6:Fluid flow model: mathematical model used to describe the fluid level in a reservoir subject to randomly determined periods of filling and emptying. Straight line model: usually written this way: y = mx + b.

Question7: it is the anticipated number of handoff experienced by one UE per time.

Question8: intra: switch inside the cells; inter: switch among different cells.

Question9:
$H_{kj}(R_0) \triangleq \frac{1}{\pi} F(\beta_{kj})\beta_{kj} \frac{pdf_{R_j} R_0 \beta_{jk}}{ccdf_{R_j}(R_0 \beta_{jk})}$

$F(\beta) \triangleq \frac{q}{\beta^2} \int_0^\pi \sqrt{(\beta^2+1) - 2\beta\cos(\theta)} \, d\theta.$

Question10: To subdivide the congestive cells into subcells, thus they can own their BS.

Question11: it can make an networks interact with other networks.

Question12: Location update: enables mobile services to inform cellular systems; Service delivery: defines the business of IT.

Question13: Time-based:easy to manage,can set different T; Movement-based: error might appear while travelling around boundary; Distance-based: simple.

Question14: pointer-forward scheme:to minimize network signaling cost from mobility management operation.
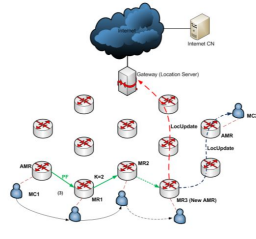
Fig. 1.   Question6.14

Chapter7

Question1: So as to acquire a permanent address on the internet.

Question2: MN = Mobile Node; HA = Home Agent; FA: Foreign Agent; COA = Care of Address; CN = Correspondent Node.

Question3: FA utilize reverse tunneling by tunneling the MN's packets to HA.

Question4:

Question5: FA adds registered MN to the visitor table and relays registration requests between MN and HA.

Question6: so that if a registration might have error, it will not occupy the service too long.

Question7:

Fig. 2.   Question7.7

Question8:

Fig. 3.   Question7.8

Question9: mobile node might fail authentication.
Quesition10:
Question11: the original IP package would be encapsulated in data payload of another data package. IP address would
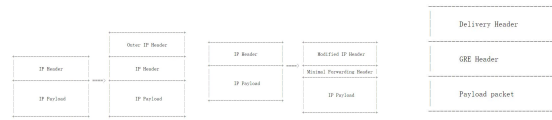

Fig. 4.   from left to right:IP MINIMAL GRE

be grouped and encapsulated respectively at the beginning of tunneling, and would be split at the end of tunneling.

Question12: Direct Delivery Style only supports reverse tunneling of unicast packets and because it is too simple?

Question13:

Chapter8

Question1: DCF = Distributed Coordination Function; PCF = Point Coordination Function; DIFS = DCF Inter Frame Space; SIFS = Short Inter Frame Space; PIFS = PCF Inter Frame Space.

Question2: DCF gets an selective virtual carrier sense mechanism which enables it to exchange short RTS amd CTS frames.

Question3: 802.11e = a proposed enhancement to the 802.11a and 802.11b wireless LAN (WLAN) specifications; EDCA = Enhanced Distributed Channel Access; HCF = Hybrid Coordination Function.

Question4: Infrastructure:communicate indirectly, through centralized access points. Ad-hoc: peer to peer.

Question5: Infrastructure: BS:connects mobiles into wired network,handoff: mobile changes base station. Adhoc does not seem to need any other element to facilitate communication.
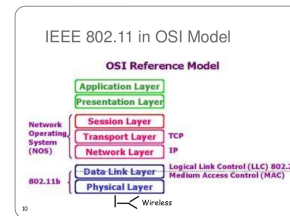
Question6:

Fig. 5.   Question8.6

Question7: LLC: provides multiplexing mechanisms that make it possible for several network protocols to coexist within a multipoint network. MAC:provides addressing and channel access control mechanisms that make it possible for several terminals or network nodes to communicate within a multiple access network that incorporates a shared medium.PLCP: delivers incoming frames from the wireless medium to the MAC layer. PMD: provides transmission and reception of Physical layer data units between two stations via the wireless medium.

Question8: Infrared: pulsating beams, travel in direct line, demand special receiver. Radio: transmit via electromagnetic wave, further distance, vulnerable to electronic interference.

Question9: 802.11, 802.11b, 802.11a, 802.11g, 801.11n, 802.11ac.

Question10: the shorter arbitration inter-frame space (AIF-S), the higher priority.

Question11: DCF: duration field, indicate how long the station will require the medium. PCF:a point coordinator in the access point controls, stations can thus transmit during any give period of time.
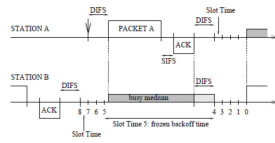
Question12 please see figure4

Fig. 6. Question8.12

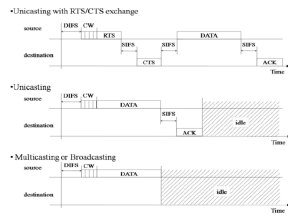Question13 please see figure5

Fig. 7. Question8.13

Question14: NAV is used to inform the nodes how long the nodes dominate the channel, if one of receiver or transmitter do not transmit the NAV, they will be unable to coordinate.

Question15: In 802.11e, Adhoc: Through INSIGNI-A,INORA and SWAN. Infrastructure mode:By PCF and HCF.

Question16: It is important that stations wake up at the same moments or they might still miss each other.

Question17: In adhoc, each station in a basic service area maintains a copy of the timing synchronization function (TSF), which is a local timer synchronized with the TSF of every other station in the basic service area.

Question18: Beacons can operate periodically and advertise capability.

Question19: Yes. Not the best. Due to the higher propagation delays, higher relative clock skews and longer inter-sync periods.

Question20: Without it, the power cost will be considerable, moreover it might cost harm to terminals and base station.

Question21: Both of them make use of PS mode. Adhoc: stations tell which stations are in PS mode by guessing. Infrastructure: stations inform the AP on entering PS mode.

Question22: DTIM is a period, and it decides how long the STA should sleep. ATIM: it is a frame, all stations will be active mode in ATIM window.

Question23: Through Hard Handoff. Receive BS's radio message, and get neighboring cell's message and get the distance

Question24: Since the system capacity is impossible to transmit a large data one time, we need to fragment the message.

Question25: Through Control Field, the working station can change its working mode such as active mode or PS mode.

Question26: Cause they contain Dest PAN ID, Dest Addr, Source PAN ID.., one address is far from enough.
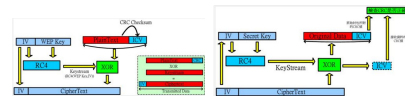

Fig. 8. Question8.30

Question27: 802.11a: a improved standards of 802.11b, which has been widely applied in public places. Since the modulation of physical layer of 802.11a is OFDM, it is totally different from 802.11b and 802.11.

Question28: To provide data confidentiality.

Question29: WEP uses the stream cipher RC4 for confidentiality,and the CRC-32 checksum for integrity.

Question30: It's one the figure6.

Question31: If the decrypted text matches the original challenge text,access point and station share WEP key.

Question32: WEP: demand of keys(hard for cracking); algorithm vulnerability.MAC filtering: Whitelist blacklist; Sacrifice convenience. Captive portals: bonding between network operation and content providers; authenticated target's risk of being spoof.

Question33: Active: client transmits probe request and listens for a probe response. Passive:client listens on each channel for beacons.

Question34: Through EDCA,By setting different min and max back-off slots.

Question35
$$S = nS_{indv}, S_{indv} = \frac{1}{n}\frac{P_s E[P]}{(1-P_{re})\sigma+\bar{T}_s+\bar{T}_c}, \bar{T}_s = \frac{P_s}{n}\sum_{i=1}^{D}n^i T_s{}^i, \bar{T}_c = \sum_{i=1}^{n-1}\sum_{j=1}^{D}\sum_{k=1}^{n^j}\binom{n-k-\sum_{j=1}^{j-1}n^l}{i}$$

Chapter9

Question1: Longer transmission distance, better stability and greater extension.

Question2: WMAN-OFDMA: with 2048 sub carrier wave, OFDM modulation, acceptable bandwidth of channel should be larger than 1MHz.

Question3: data be modulated onto adjacent carriers and be transmitted simultaneously.

Chapter10

Question1: Infrastructure:communicate indirectly, through centralized access points. Ad-hoc: peer to peer.

Question2: Ratio-k model,a transmission is regarded as not being interfered by an interferer if the interferer is at least K times the transmitter-receiver distance away from the receiver

Question3: Values of parameters of the new theory were inside certain region of the parameter space, the experiment found evidence against the old theory in favor of the new one.

Question4: Upper bound: to simplify the joint distribution such that marginalization can be accomplished efficiently, while maintaining at all times a rigorous upper bound on the desired marginal probability. The general approach is to introduce additional parameters into the problem that can factorize the joint distribution over the variables.

Question5: Hidden :in the receiver's coverage ,out of transmitter's coverage. Exposed : out of the receiver's coverage ,in the transmitter's coverage.

Chapter11

Question1: Workstation sends the authentication frame, and AP return a verification frame. Then AP will receive third frame, if it is same to the one it sent, then successful.

Question2: Applicants EAPOL Start frames to certifier, then certifier ask for applicants' identity. Applicants sent the identity information. Certifier receives it and encapsulates int RADIUS Access Request frame and sends to AS. Result depends on the authentication.

Question3: WEP's core is RC4 sequence coding algorithm and it has drawbacks such as one-sided authentication; WAPI is improved based on WEP, it contains ASU which is trusted third party, STA and AP which are two-way authentication; 802.11i is also improved based on WEP. It includes 802.1x into WLAN, enforce identity authentication in WLAN and apply two more encryption mechanisms:TKIP and CCMP.

Chapter12

Question1: improvement of transmission distance(up to 60m) and reduction of power consumption.

Question2: Stand-by State, Intermediate State and Connecting State.

Question3: Reader: handle two-way communication with electronic tag, and it is RFID's system information control and processing center; Electronic tag:is used for communication with the reader.

Questino4: Chip technology, RFID anti-collision technology, security privacy issues.

Question5: Logistics transportation management, retail merchandise and Manufacturing process.
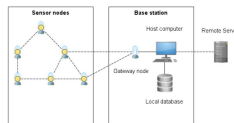
Chapter13

Question1:

Fig. 9. Question13.1

Question2: Perceptual acquisition unit, Computing unit, Communication unit and Power unit.

Question3: Mobile: military use such as smart dust and C4ISRT system; Stationary: medical and health use such as hospitalized patient management and remote health monitoring.

Question4: Aircraft sowing, artificial embedding or rocket ejection.

Question5: it subject to IEEE 802.15.4, and data rate reaches to 40kb/s, and the communication range is up to 1000 feet.

Question6:

Question7: Battery or solar power supply

Chapter14

Question1: Ultra wideband,Software defined radio,RFID

Quesiton2: Reliable security, great multi-path resolving ability, high transmission rate and most importantly, low cost.

Question3: BLE pay more emphasis on reduction of power consumption and thus performance is inevitably compromised.

Question4:Particular frequency is transmitted when you choose your preferred station on radio. Range of antenna is tuned to set the station by detect the frequency signals.

Question5: Features: small size, easy to configure, low cost, ; Application: health care such as intelligent diagnosis, patient care and automatic delivery system.

Chapter15

Question1: SDN achieve the separation of the control layer and the forwarding layer, and achieve centralized management and programmable network through standardization instead of IP.

Question2: Separation of data forwarding and control, network equipment control plane and data separation,network virtualization and open interface.

Question3: Traffic visualization, prevention of DDOS and cloud security.

Question4: Separation of network control and physical topology network cause less hardware restrictions on the network architecture. Central management of networks nodes cause more reliable network data.

Chapter16,17&18

Question1: Motor, various kinds of sensors, camera, microphones and network communication module.

Question2: Wireless sensor networks, automatic parking and self-driving car. Self-driving car: incorporates automatic control, AI and numerous technology. It replace our dependance on visual with sensors and computer and they can prevent speeding and fatigue driving.

Chapter19

Question1: SISO uses a single antenna to send and a single antenna to receive. MIMO uses multiple antennas to send and multiple antennas to receive and thus there are multiple transmission paths between the transmitter and receiver.
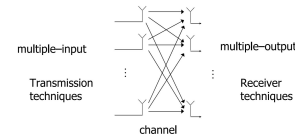
Question2

Fig. 10. Question19.2 Channel Model

Question3: Space diversity: receive multiple copies of the same information through multiple channels. Space multiplexing: using multiple antennas at the receiving and transmitting ends, making the most of the multipath components in spatial propagation

Question4: Multiuser MIMO, Networked MIMO and Distributed MMIMO. Distributed MIMO: It combines the distrbuted antenna system with MIMO technology's multi-antenna. Due to the flexibility of the architecture, it has a unique advantage in overcoming the channel shadow effect and providing greater spatial diversity.

Chapter21&22

Question1: Security of monetary value: value usually fluctuates, and it's not safe.Account security: Users can generate a wallet.dat file offline to keep bitcoin. Yet once the wallet is lost, users are unable to retrieve it. Security of the transaction: block chain makes it safe.

Question2: Blank area, Position detection pattern, Positioning graphics and Data and error correction codewords.