Ch1

Q1: 1831, Faraday invented Electromagnetic induction;
1837, Morse invented telegraph.
1873, Maxwell proposed the theory of electromagnetic field.
1876, Bell invented the phone.
1895, Marconi invented radio.
1927, the first television broadcast. 1946, the first mobile phone system.
1958, SCORE satellite. 1981, NMT. 1988, GSM.

Q2: Cellular system, Mobile management, Mobile IP, Wi-Fi, WiMAX, Wireless Network Security, IOT, Software defined network ...

Ch2

Q1: Wired media: visible, more reliable, guided connection, Not shared.
Wireless media: invisible, less reliable, non-guided link, shared.
Wireless media: 5GHz(WLAN), 28~60GHz(LMDS), PCS...

Q2: Licensed: For specific use, including 5GHz(WLAN), 28~60GHz(LMDS), PCS...
Unlicensed: For Pubic use, including ISM and U-NII

Q3: Frequency, Terrain, the velocity of mobile terminal, distance;

Q4: Reflection: When $\lambda <$ the size of obstacles, Reflection occurs on the surface.
Diffraction: When the propagation path is blocked by sharp edges, the secondary wave produced by diffraction are scattered in space.
Scattering: When $\lambda \geq$ the size of obstacles and they have a large ~~number~~ density in the space, Scattering happens.

Q5: Indoor: Within transmission range, Reflection is a main factor and diffraction is relatively weaker. Beyond the Range, scattering appears.
Outdoor: Mainly effected by reflection of buildings and ground, diffraction of roof and walls and scattering. Reflection is not the main mechanism.

Q6 $\frac{P_r}{P_t} = G_t G_r \frac{h_t^2 \cdot h_r^2}{d^4}$

Q7. Two-ray modeling: pass loss: $-\alpha \lg(d)$; receiving power: $P_r = P_0 \cdot d^{-\alpha}$.
transmission delays: $(x+x'-l)/c$;
Free space modeling: $L_P[dB] = 32.45 + 20\lg f_c[MHz] + 20\lg d[km]$
$P_r = \frac{G_t G_r P_t}{L}$; transmission delays: $(x+x'-l)/c$

Q8 concept: caused by shadow, the long-term changes of signal strength at the average level.
effect: change slowly with distance, can't receive enough signal strength at a distance to get correct information (no interference)

Q9. fade margin: $A_F = G_T + G_R + P_T - (L_{K1} + L_{K2} + L_P + L_F) - P_{th}$

Q10. Macrocell: $L_P[dB] = (44.9 - 6.55\log_{10} h_{bs}) \frac{d}{100} + 45.5 + (35.46 - 1.1 h_{ms})\log_{10}(f_c) - 13.82\log_{10}(h_{bs}) + 0.7 h_{bs} + C$
Microcell: $L_P[dB] = -55.9 + 38 \times \log_{10}(d) + (24.5 + 1.5 \times f_c/925) \times \log_{10}(f_c)$.

Q11 Fading: Signal Amplitude fluctuation, Bit error rate increasing;
Droppler shift: receiving wave frequency changes.

Q12. If there is no main static signal component in the ~~multiple~~ multipath components of the received signal, the received signal submits Rayleigh distribution, with statistically independent amplitude and phase.
Otherwise, if there is a main signal component, the received signal submits Ricean distribution.

Q13. the change in frequency or wavelength of a wave for an observer moving relative to the source.
$f' = f + v(t)$; $v(t) = \frac{Vf}{c}\cos\theta(t)$.

Q14 Rayleigh: $P(R \leq R_m) = 0.5$ $(R_m = 1.1776)$

Q15. $LCR = \sqrt{2\pi} f_d \rho \cdot e^{-\rho^2}$, $AFD = \frac{1}{LCR}$.

Ch3&4.

Q1. based on the new technology - CDMA, increase data rate and realize the global coverage of multimedia mobile communications.

Q2: $C = M/N$, $D = \sqrt{3N}R$, $P_e(dBW) = P_0(dBW) - 10k\lg\frac{d}{d_0}$, $d > d_0$

Q3: $q = \sqrt{3N} = (N_I \times \frac{S}{I})^{1/k}$

Q4: base stations: fixed location to relay information;
Down link: Satellite down to more ground stations;
Uplink: ground stations up to a satellite,
Cells: area covered by cellular telephone transmitter
Location areas: the areas cells locate;
MSC: mobile switch center, the center of a network switching system

Q5: HLR: store the details such as ID or billing details.
VLR: provide a local database for the subscribers wherever they are physically located within a PLMN.

Q6: Handoff: enable mobile nodes to keep connection active when moving from one cell to another cell.
Location: enable the mobile nodes to send or receive information normally even in an offsite network.

Q7. Faster data rate, global coverage, multimedia communication service, improvement of stability.

Q8. TDMA: digital modulation, limited system capacity
CDMA: greater capacity, better QoS;

Q9. SGSN/GGSN: packet routing and transfer, mobility management.
MSC/GMSC/HLR: ~~make it possible to~~ location management, Dynamic Channel management, communication data collection. switching based on IP, ATM, AAL2 as well as TDM;

Q10. WCDMA, CDMA2000, TD-CDMA

Q11. CDMA, Global Multimedia communication.

Q12. 2.5G: 160Kbps, 1.6MHz, 450MHz
3G:

Q13. FDMA: Advanced Mobile Phone System, CT2;
TDMA: U.S. Digital Cellular
CDMA: 3G, 4G, U.S. Narrowband Spread Spectrum.

Q14. a 3G all-IP network based on Softswitch technology and SIP (Session Initiation Protocol)

Ch5

Q1. Mobile cloud computing, Mobile web pages, Mobile access, Pervasive computing

Ch6.

Q1. Judgement of a mobile node's leaving; Identification of new basestation; allocation of new ~~free~~ communication channels

Q2. ~~Both are~~ hard hand-off
intra ~~cell~~: change a channel which may be interfered or fading with a new clearer channel.
inter ~~cell~~: maintain the call as the subscriber is moving out of the source cell and entering the target cell.

Q3. MCHO: Mobile Controlled Hand-off; NCHO: Network Controlled Hand-off
MAHO: Mobile Assistant Hand-off

Q4. Hard: save channel resources but communication quality declines when breaking
Soft: communication quality is better but occupy more channel resources

Q5. ~~Straight-line~~: Mobile nodes automatically sensor the signal strength from BS and send results to BS.

Q6. Straight-line: $y = kx + b$
Flow

Q7. the anticipated number of handoff experienced by one UE per time

Q8. intra: switch inside the cells; inter: switch among different cells.

Q9. $H_{kj}(R_0) \triangleq \frac{1}{\pi} F(\beta_{kj}) \beta_{kj} \frac{\rho d R_j R_0 \beta_{in}}{c\omega d(R_j(R_0 \beta_{kj}))}$; $F(\beta) = \frac{9}{\beta} \int_0^{\pi} \sqrt{(\beta+1) - 2\beta \cos\alpha} \, d\alpha$

Q10. cell splitting will increase handoff rate.

Q11. with two levels, more steady.

Q12. Location update: enables mobile services to keep connection steady
Service delivery: defines the business of IT

Q13 Time: easy to manage, set different T_i; Movement: error may happen when be around boundary; Distance: the simplest

Q14. pointer forward scheme: minimize network signaling cost in the mobility management

Ch7.

Q1. Having a permanent IP means that a mobile computer which is always moving can access any network without breaking and reconfiguring.

Q2. MN = Mobile Node; HA = Home Agent; FA = Foreign Agent; ~~CoA = Care of Address; CN = Corresponding Node;~~ CN = Communication Node; CoA = Care of Address;

Q3. FA utilize reverse tunneling by tunneling MN's packets to HA.

Q4. HA ← Internet CN; HA → packaging → FA ⇄ MN

Q5. MN initiates and sends request to FA. FA adds MN to the visitor table and send request to HA. HA then deals with it and sends the result to FA and FA sends result to MN.

Q6. Avoid that A registration process occupy the service or resources too long if error happens.

Q7. Type = 16; Length = 6 + 4×N; Sequence Number; Registration lifetime; R = Registration required; B = Busy; H = Home agent; F = Foreign Agent. M = Minimal Encapsulation; G = Generic Routing Encapsulation; V = Van Jacobson header compression. Reserved: for future use. CoA;

Q8. Type = 1 (Registration Request); S = Simultaneous bindings. B = Broadcast datagrams. D = Decapsulation by mobile node; M = Minimal encapsulation.

Q9. mobile node fails authentification or mobile node doesn't renew before the bound with HA times out.

Q10. IP in IP: Original IP Packet becomes the payload of new one. Minimal: New IP header is inserted into original IP header and payload. GRE: Encrypt another protocol on original protocol. IP in IP is most common while Minimal can save extra bytes.

Q11. the original IP Packet would be packaged in the payload of another packet to transfer. After receiving, the package would be split.

Q12. Have no idea about this.

Q13. Have no idea about this.

Ch8.

Q1. DCF = Distributed Coordination Function; PCF = Point Coordination Function; DIFS = DCF Inter Frame Space; SIFS = Short Inter Frame Space; PIFS = PCF Inter Frame Space;

Q2. DCF gets on selective virtual carrier sense mechanism which enables it to exchange short RTS and CTS frames.

Q3. 802.11e = a proposed enhancement to the 802.11a and 802.11b WLAN specifications; EDCA = Enhanced Distributed Channel Access; HCF = Hybrid Coordination Function;

Q4. Infrastructure: AP relay all the communication as the center node; Ad-hoc: no center node, all nodes are equal.

Q5. STA: workstations; AP: Access points; ← Infra ⇄ ESS; Ad-hoc only has STA; → IBSS

Q6. Network Interface layer (MAC + Physical Layer)

Q7: LLC: Logic Link Control
MAC: Media Access Control
PLCP: Physical Layer Convergence Procedure
PMD: Physical Media Dependent

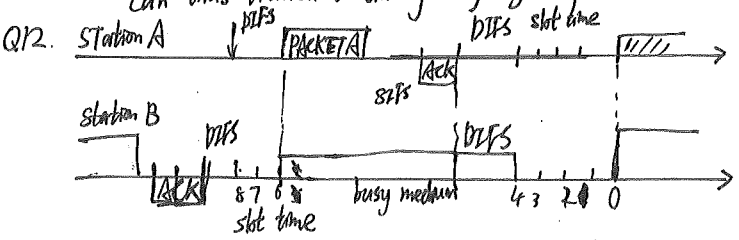
Q8. Infrared: travel in direct line, can't be obstructed, low cost
Radio: all-direction, long distance, relatively higher cost.

Q9. ~~BESS~~ PLCP. PMD

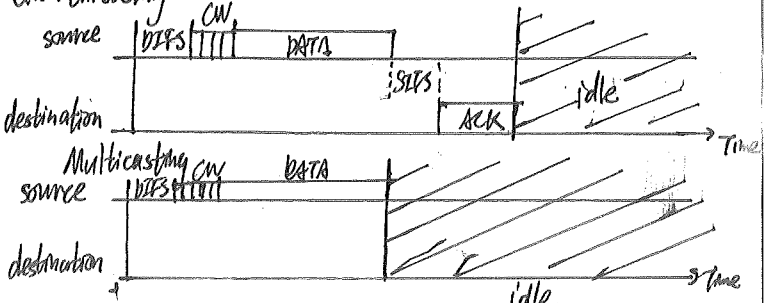
Q10. the shorter arbitration inter-frame space (AIFS), the higher priority.

Q11. 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 given period of time.

Q12.



Q13. Unicasting



Q14. NAV is used to inform the nodes how long the nodes occupy the channel, if one of receiver or transmitter doesn't transmit NAV, they will be unable to coordinate.

Q15. Adhoc: through INSIGNIA, INORA and SWAN.
Infrastructure: by PCF and HCF;

Q16. to avoid that stations may miss each other.

Q17. adhoc: each station maintains a copy of the timing synchronization function (TCF).

Q18. Beacons can operate periodically and advertise capability.

Q19. Yes, but not very well. Because of higher propagation delays, higher relative clock skews and longer inter-synperiods.

Q20. To decrease power cost and avoid possible harm to ~~terminal~~ stations.

Q21. With PS mode.
Ad-hoc: stations tell which stations are in PS mode by guessing.
Infra: stations inform the AP on entering PS mode.

Q22. DTIM decides how long STA should sleep.
ATIM is a frame, ~~that~~ all STA will be active in ATIM window.

Q23. Hand Hand-off.
Receive BS's radio message, get neighbouring cell's message, get the distance.

Q24. The system capacity is not big enough to transmit a large data at one time.

Q25. Through Control Field, station can change its working mode, such as active or PS mode.

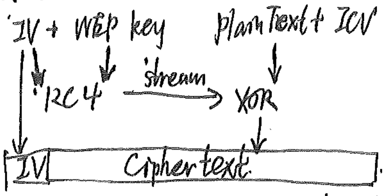
Q26. It contains Dest PAN ID, Dest Addr, Source PAN ID, Source Addr.

Q27. 802.11a: a improved standards of 802.11b and 802.11.
802.11a uses OFDM as the modulation of physical layer, which is totally different.

Q28. To protect the security of wireless network.

Q29. WEP uses the stream cipher RC4 for confidentiality and CRC-32 checksum for integrity.

Q30.



Q31. If the decrypted text matches the original question text, access point and the station share WEP key.

Q32. WEP: demand of keys, don't work for monitoring, low cost.

MAC filtering: Whitelist blacklist, lack for convenience

Captive portals: bonding between operation and providers, risk of being spoof.

Q33. Active: client transmits probe request and listens for a probe response.

Passive: client listens on each channel for beacons.

Q34. Through EDCA, by setting different min and max back-off slots.

Q35. ~~$S = nS_{ndv}$, $S_{ndv} = \frac{1}{n}\frac{P_s E[P]}{(1-P_{re})\sigma + T_s + T_c}$, $T_s = \frac{P_s}{n}\sum n^i T_s^i$~~

n-SRRGM model, $D_n(N) = 1 + \sum_{m=1}^{N} \frac{1-q^m}{q^{(m-1)n}} \left(\frac{q^m - q^{mN}}{1-q^m} - \frac{q^{(m-1)n} - q^{(M-1)nN}}{q^{n-1}(1-q^{(m-1)n})} \right)$,

Ch9.

Q1. longer transmission distance, better stability and greater extension

Q2. WMAN-OFDMA: OFDM modulation, 2048 sub carrier waves.

Q3. data is modulated onto adjacent carriers and is transmitted at the same time.

Ch10.

Q1. Infra: communicate directly, through centralized access points.

Ad hoc: peer to peer.

Q2. Radio-K model, a transmission is regarded as not being interfaced by an interferer if the interferer is more than K times the t-r distance from the receiver.

Q3. ~~Values of parameters of a new theory~~ Values in exclusive region are invalid or meaningless.

Q4. Have no idea about this.

Q5. Hidden: in the receiver's coverage, out of transmitter's coverage;

Exposed: out of the receiver's coverage, within the transmitter's coverage.

Ch11.

Q1: The workstation sends the authentification frame. AP returns a verification frame. The workstation obtains the question text and encrypt and send an authentification management frame. AP decrypts the text with WEP key. If it is same as the original text, authentification succeeds.

Q2. The applicant sends the EAPOL start frame to the certifier. The certifier requests for relevant identity information. The applicant sends ID information. The certifier sends the RADIUS Access Request Frame to the AS. The RADIUS server verifies and informs the authentification results to the certifier and then the applicant.

Q3. WEP: its core is the RC4 algorithm, one-sided ID authentification; don't work for monitoring attack;

WAPI: improved based on WEP, add ASU as a trusted third party to manage certificates; twoway authentification, use SMS4 algorithm;

IEEE 802.11i, a new generation of security standards on WEP, better stability, add key management mechanism, use two new encryption mechanisms: TKIP and CCMP.

Ch12.

Q1. the same transmission rate; increase transmission distance (up to 60m); reduce energy consumption (90% lower than 3.0)

Q2. Stand-By state; Intermediate State; Connecting State;

Q3. Readers, two-way communication with the electronic tag, RFID's system information control and processing center.

Electronic tags, composed of IC chips and antennas, used for communication with the reader.

Q4. Chip technology, Antenna Design technology, Label application technology, security privacy issues.

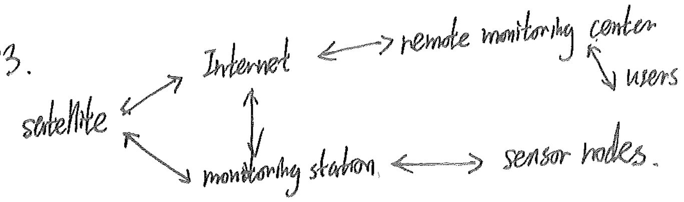
Q5. Logistics transport management: cargo tracking, information collection;

Retail merchandise management: collecting real-time statistics; automatic security

Manufacturing process management: real-time monitoring, tracking, positioning;

Ch13.

Q1.



Q2. consisting of four elements:

Perceptual acquision unit: converts environmental objects into electrical signal

Computing unit: the core of node, the whole control and allocation

Communication unit: send the data to another node.

Power unit: power supply

Q3. Millitary use: smart dust. ALine in the sand

Medical and health use: remote health monitoring

Environmental and agricultural use: biological environment monitoring system;

Q4. Aircraft sowing; Artificial embedding; Rocket ejection

Q5. compliant with IEEE 802.15.4 standards, data rate 40kb/s; communication range up to 1000 feet;

Q6. Have no idea about this.

Q7. Battery, Solar power supply;

Ch14.

Q1. Ultra Wideband; Software defined radio; RFID; Body Area Network;

Q2. Good security; High processing gain; High multi-path resolving ability, high transmission rate; large system capacity; strong anti-jamming ability; low power cost; Accurate positioning; low cost;

Q3. BLE protocol further simplifies the classic Bluetooth protocol stack with data transmission rate and power consumption as the main technical indicators. BLE has two modes: single-mode and dual-mode.

Q4. CR captures information from the wireless environment to identified unused spectrum resources and select the best parameters and then the CR devices can be dynamically programmed to use different wireless technology to receive or send data.

Q5. BAN consists of a set of sensors and a BAN coordinator.
Features: Small size; easy to configure, low cost, low power consumption, high reliability;
Wireless communication is robust enough to withstand RF interference.

Applications: Health care: smart diagnosis, treatment; patient care.
Navigation and positioning services;
Personal multimedia entertainment;

Ch15.

Q1. SDN is a programmable network architecture, separates the control layer and the forwarding layer. Users can customize the application at the highest layer to trigger the definition of the network.

Q2. Separation of data forwarding and control (layers)
Network virtualization.
Open interface

Q3. Cloud security
build intelligent campus network, achieve seamless access; business traffic isolation.
SDN enterprise-class WLAN network, achieve mobility management, load balancing
used in telecom operators network.

Q4. SDN separate network control and physical topology network to get rid of the hardware's restrictions on network Architecture. SDN manages all the network nodes centrally, making the control and management of data more efficient and stable, reducing the resource cost and improving the utilization rate of each link.

Ch 16 & 17 & 18.

Q1. motor, all kinds of sensors camera, microphone, communication module;

Q2. self driving car: combine automatic control, artificial intelligence and visual computing, use computers and sensors to replace people in driving.
Wireless sensor network; Automatic parking;
Urban Traffic safety and Planning;

Ch 19.

Q1. SISO is a single input single output system, only one transmission path between transmitter and receiver.
MIMO is a multi-input multi-output system, with multiple transmission pathes.

Q2. MIMO: the channel model is:

$$y = Hx + n$$

$x = [x_1\ x_2\ \cdots\ x_{N_T}]^T$, transmission signal.

$y = [y_1\ y_2\ \cdots\ y_{N_R}]^R$, receiving signal.

$n = [n_1\ n_2\ \cdots\ n_{N_R}]^T$, channel noise.

$$H = \begin{bmatrix} h_{11} & h_{12} & \cdots & h_{1N_T} \\ h_{21} & h_{22} & \cdots & h_{2N_T} \\ \vdots & \vdots & \cdots & \vdots \\ h_{N_R1} & h_{N_R2} & \cdots & h_{N_RN_T} \end{bmatrix}$$, Channel matrix.

Q3. Space diversity: receive multiple copies of the same information through multiple channels, to restore the original signal more correctly. It can be used to reduce transmitting power.
Space multiplexing, use multiple antennas at the receiving and transmitting ends, making full use of the multipath components, using multiple data channels to transmit signal at the same frequency to increase system capacity.

Q4. MIMO Radar: a number of antennas transmit different orthogonal waveforms, covering large airspace, using long-term coherent accumulation to get a higher SNR.
Distributed MIMO;
Combined with cellular system, used in 4G;

Ch 21 & 22.

Q1. Bitcoin value fluctuates greatly, 7times of gold. The security of monetary value is not good.
Bitcoin's wallet may be lost and faces the risk of being stolen.
Account security is not very good.
The existence of the block chain makes Bitcoin's transaction very safe.
The privacy of both parties of Bitcoin transaction is protected very well.

Q2. Blank Area; Position detection pattern, Separator, Positioning graphics, Correcting graphics, Format info.; Version info.; Data and error correction codewords