# TELE303 Exam Review Point

20 questions

3 hours

No calculators

Testing on understanding/application rather than memorization, but:

Important acronyms

Important theorems (what application uses these?)

Wireless fundamentals 35%

Technologies 15%

Android 50%

## **Transmission**

Analog vs digital

|  |  |
| --- | --- |
| Analog signal | Digital signal |
| Signal intensity varies in a smooth fashion over time  A continuous varying electromagnetic wave that may be propagated over a variety of media, depending on frequency. | Signal intensity varies only on constant levels over time.  A sequence of voltage pulses that may be transmitted over copper wire medium.  Generally cheaper than analog signaling.  Less susceptible to noise inference.  Any digital waveform will have infinite bandwidth.  Suffer from attenuation. |

|  |  |
| --- | --- |
| Analog signal transmission | Digital signal transmission |
| Transmit analog signals without regard to content.  Attenuation limit the length of transmission link.  Cascaded amplifier boost signal energy for long distance but cause distortion.  Analog data can tolerate distortion while introduce error in digital data. | Concerned with the content of signal.  Attenuation endanger the integrity of data. |

**Conversion**:

|  |  |  |
| --- | --- | --- |
|  | Digital data | Analog data |
| Digital signal | Digital to digital conversion  Line coding |  |
| Analog signal | Analog signal -> Digital data(digitization)  Analog to digital conversion  Pulse Code Modulation (PCM)  Delta Modulation (DM)  Digital data <- Analog signal (modulation)  ASK, FSK, PSK and QAM(the combination of ASK and PSK) |  |

Nyquist’s sampling theorem

The sampling rate should be at least 2 \* the highest frequency in the signal.

Shannon’s Capacity Theorem:

Capacity = Bandwidth \* Log2[1 + SNR], SNRdB = 10Log10[signal power / noise power]

In practice, much lower rates achieved

* Formula just assume white noise
* Impulse noise is not accounted.
* Signal distortion is not accounted.

SNR set the upper bound on achievable data rate

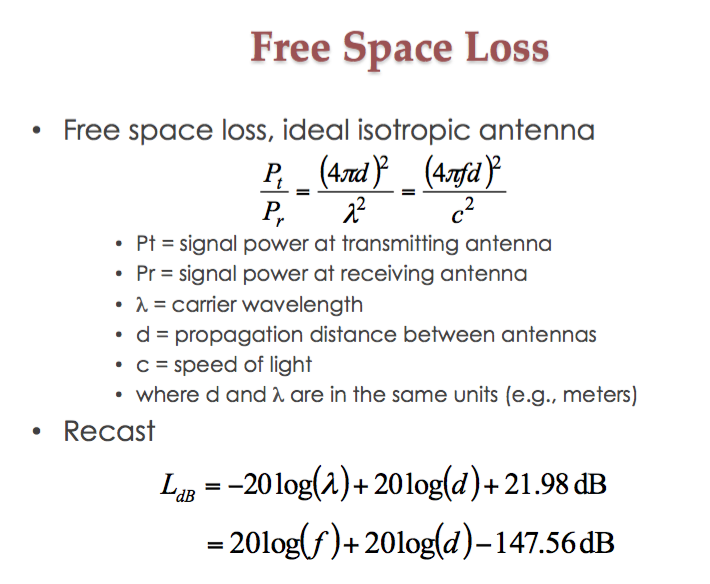
A higher SNR means a high – quality signal, low number of required intermediate repeaters.

Nyquist’s formula:

Capacity = 2 \* Bandwidth \* Log2[L], L is the level of signals

Free space loss

-Such as. 2\* the distance, 10\* frequency (recast?)



## **Impairments**

See short answer question from previous exam paper

* Attenuation and attenuation distortion
* Noise
* Atmospheric absorption
* Multipath
* Refraction

## **Multiplexing:**

* TDM
* FDM
* CDM
* OFDM

Duplexing:

* FDD
* TDD

|  |  |
| --- | --- |
| FDM | TDM |
| * Take the advantage of the fact that the useful bandwidth of the medium exceeds the required bandwidth of a given signal * Guarded band between channels needed * Easy to implement in analog system | * Take the advantage of the fact that the achievable bit rate of the medium exceeds the required data rate of a signal. * Format flexibility and lower power consumption. * Can be synchronize or statistical. |

|  |  |
| --- | --- |
| FDD | TDD |
| * Easy to implement * Need guard band * Favored in WCDMA | * Synchronization required * Stringent requirement on RTT * Can be made adaptive * Used in TD-SCDMA |

## **Medium access control**

|  |  |  |
| --- | --- | --- |
| TDMA | Flexible data rate  Enable frame by frame monitoring  More efficient, no guard bands needed | Strong synchronization required  More power consumption  Required substantial amount of DSP.  Guard time between slots need to be long enough to cope with delay variance. |
| FDMA | Capacity can scale  Device implementation simple | Capacity scale depend on low SNR  Fixed data rate  Inefficient: guard bands needed  Crosstalk between channel possible |
| CDMA | Walsh Table, need to know use PN code to solve problem | |
| CSMA/CA | Carrier sense multiple access with collision avoidance.  It is invented for wireless communication; collisions are avoided using CSMA/CA’s three strategies:   * The interframe space * The contention window * Acknowledgement     Hidden station problem | |

Also see exposed Terminal problem

## **Spread Spectrum**

What is gained from the waste of spectrum

Frequency hopping

Slow FH, fast FH

MFSK: Learn to draw the hopping, low or fast?

Direct Sequence

* Walsh (preferred in some reason) and PN
* Near far effect, solution to near far effect

FHSS VS DSSS

## **MANETS**

Flooding vs Routing

Proactive vs reactive outing

DSR & AODV

REQ, REP

Sensor networks (different between MANET and Routing)?

Secure routing? Solution?

## **Wireless Security**

Issue: unauthorized access: authentication

Data interception: Confidentiality/ integrity

Types of attacks / impact

Physical and medium level

Weakness and improvements: WEP, WPA

How to cope with threats

Network layer & above

Attack

## **Technologies:**

Cellular

Wireless LANS

Why TDMA improved, to gain higher capacity

Satellites

Wireless sensor networks

## **Cellular systems**

System architecture

Frequency reuse

MTSO

HOW TO increase capacity?

Need of adoptive power control (why need adoptive)

Handoffs, hard hysteresis, soft

Evolution of technologies: GSM, CDMA, WCDMA/CDMA2000, LTE

OFDM

Advantages AND disadvantage of wireless communication

Range of uses:

LAN extension. cross building, nomadic, ad hoc

Wireless LAN techniques: inferred,

Lecture notes: important.

Tutorial assignment,

**Android Section**

**Review Lecture**

Lectures 9 - 10

* Ubiquitous Computing, Mobile Computing, Pervasive Computing
  + Principles and features of Ubiquitous Computing
  + Natural user interfaces, context awareness, automatic capture and access.
* History of Ubiquitous Computing
  + High integration of capabilities (SoC, Sensors, Cam, Wireless, Audio, Video, …)
  + User interface and mobile environment (applications, app stores, business model) are very important for long term success
  + Many examples "underdogs" played major role because of their advantage in these areas (Palm, Apple iPhone, Blackberry, …)

Lecture 11

* Human-Computer Interaction
  + Design, prototyping, implementation & evaluation of Uis
  + Uis
    - Part of application that allows
      * People to interact with computer
      * Computer to communicate results
  + HCI is cost and time demanding
  + Is very important to commercial success (see iPhone, Google Glass, etc….)
* Prototyping/Sketching mobile applications
  + Design Cycle
  + Sketching is a valuable tool for many of those steps!

Lecture 12

* Android General
  + An open-source mobile platform developed by the Open Handset Alliance
  + Based on a Linux Kernel, Android Runtime (ART)
  + Ported to different architectures and devices
* Developers Choice
  + 3 different app models
    - Web Apps (HTML, JavaScript)
    - Android Apps (Java)
    - Android Native Apps (Mix of Java and C/C++)
* Android Anatomy
  + 4 main components:
    - Activities: single screen
    - Services: background processing
    - Broadcast receivers: broadcast messages
    - Content providers: handle data
  + Intents for wiring components
* App LifeCycle
  + Activities are managed using the Activity Stack

Process's lifetime not directly controlled by application

Lecture 13

* Views and View Groups
  + A view store's layout and content for a specific rectangular area of the screen
  + A Viewgroup contains and manages a subordinate set of views and other view groups
  + Nested class for layout parameters
* Programmatic vs. declarative XML UI
  + Application's UI is separated from the logic
  + Constructing and building the applications UI directly from source code or using XML markups
* Layouts
  + Used to layout GUI elements
  + Wide range of different layouts:
    - For static views
    - Dynamic views (using adapters)
* Fragments
  + Subactivities
  + Used to:
    - Handle different screen sizes
    - Device orientation

Lecture 14:

* Event Handling
  + Three main concepts needed for implementing Event Handling
    - Event Listeners
    - Registration of Event Handlers
    - Event Handlers
  + Different methods for registering your Event Handler
* Intents
  + An intent object is a passive data structure holding an abstract description of an operation to be performed which is used for sending messages among application components
  + Explicit vs. Implicit intents.
  + Handling of implicit intents
* Intent Filter
  + Intent Filter for informing the Android System which implicit intents can be handled
  + One job, one filter
  + Intent Matching for identifying intents and capable applications by parsing their filters
  + PackageManager for querying available applications

Lecture 15:

* General data handling
  + Preferences
  + FileIO
  + SQLite databases
  + Network storage
  + Content Providers
* File IO
  + File operations, event listeners
  + Require attention when separating private from sharing files
    - Internal files
    - External files
* SQLite
  + If multi-threaded data access is relevant or complex data is handled
  + Use of SQLiteOpenHelper for managing DB
  + Use of rawQuery() & query()
  + Databases are private (to the package)
* Content Provider
  + To share private content with another application through a well defined interface
  + Android Native Content Providers

Lecture 16:

* Threads in Android
  + A thread in computer science is short for a thread of execution
  + Android single thread model (By default, all components of the same application run in the same process and thread (called the main thread)
  + Two rules to Android's single thread model:
    - Do not block the UI thread
    - Do not access the Android UI toolkit from outside the UI thread
  + Methods accessing the UI thread from other threads
  + AsyncTask

Lecture 17:

* Location sensors
  + Navsat GPS
    - Satellite-based navigation
    - Needs min. 4 satellites
    - Uses trilateration to solve for [x, y, z, b]
      * B = clock bias
  + Assisted GPS
  + Differential GPS
  + Real time kinematics GPS
* Orientation Sensors
  + Magnetometer
    - Strength of earth's magnetic field
    - Measure error prone but absolute orientation
  + Accelerometer
    - Measures gravity
    - Very sensitive but limited scale
  + Gyroscope
    - Measures angular velocity
    - Subject to drift
* Sensor's Fusion
  + Dead reckoning to improve location estimate
  + Combine filtered sensors to improve orientation estimate

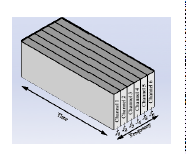
**Tele Section**

**Review Lecture**

Transmission

* Analog vs Digital
  + Why?
  + Conversion
* Conversion
  + Nyquist sampling theorem
    - Given a channel bandwidth of *B Hz* the highest signal rate that can be carried is 2B
  + PCM, DM
* Shannon Capacity
  + C, B, SNR
    - C = Capacity
    - B = Bandwidth
  + Represents theoretical maximum that can be achieved under given B and SNR

Transmission Concepts

* Free space loss
* Impairments
* Multiplexing
  + Multiplexing is carrying multiple signals on a single medium
  + TDM, FDM, CDM, OFDM
    - FDM
      * Takes advantage of the fact that the useful bandwidth of the medium exceeds the required bandwidth of a given signal.
      * 
  + Duplexing: FDD, TDD
  + Advantages/Disadvantages
* Medium Access Control
  + TDMA, FDMA, CDMA, CSMA/CA
  + Wi-fi in MANETs
  + Satellite lecture

Multiple Frequency Shift Keying

* More than two frequencies are used
* Used for frequency hopping in spread spectrum
* MFKS Table thing

- To analyse

FH: Slow or Fast?

Spread Spectrum

* What is gained from the waste of spectrum?

Anti-jamming and privacy

* Frequency hopping
  + Slow FH or Fast FH
* Direct Sequence
  + Walsh
  + PN
  + Pseudo-noise chips
  + Near-far effect
* FHSS vs DSSS
* CDMA

MANETS

* Flood vs routing
  + Flooding is used in MANETs because of the possibility of packets not being received so the sender just sends heaps of them
* Proactive vs. reactive routing
* DSR & AODV
  + DSR (Dynamic Source Routing) is used in MANETs when a node wants to send something to another node but does not actually know the route so they flood a Route Request (RREQ) which I guess each node passes onto each other until a route is formed.
* Sensor networks
* Secure routing
* Difference from traditional routing

Wireless Security

* Security issues
  + Authentication/Authorisation
  + Data interception: confidentiality/integrity
* Types of attacks/impacts
  + Physical and medium level
    - Weaknesses and improvements: WEP WPA
    - How to cope with threats
  + Network layer & above
    - MAC attacks
    - Routing attacks
    - Attacks in WSN
    - Possible solutions

Technologies

* Cellular
* Wireless LANs
* 802.X
* Satellites
* Wireless sensor networks

Cellular systems

* System architecture
* Frequency reuse
* MTSO
* How to increase capacity?
* Need of adaptive power control
* Handoffs - hard, hysteresis, soft
* Evolution of tech GSM, CDMA, WCDMA/CDMA2000, LTE

Generations of Standards

Wireless LANs