KFUPM-EE DEPT.
EE573- Digital Communications II
Dr. Ali Muqaibel
Spread Spectrum
Summary of Main Points, v. 1.0

- **Introduction**
  - Definition of Spread Spectrum and Bandwidth Expansion Factor
  - Major Applications (Jamming, anti-jamming, covert, CDMA, radar)
  - Definition of CDMA
  - Coding and pseudo-randomness
- **Types of Spread Spectrum**
  - Direct Sequence Spread Spectrum (DSSS)
  - Frequency Hopping Spread Spectrum (FHSP)
- **Model of DSSS Digital Communication System** *see figure 13.1-1*
  - Integration of Coding
- **Types of Interference (Jamming)**
  - Broadband, narrowband, tone, multi-tone
  - Continuous, pulsed
  - Fixed, time varying
- **Type of modulation considered and when?**
  - PSF and FSK
- **Modulator Demodulator digital Circuits** (13.2)
- **Error Rate Performance of the Decoder** (13.2.1)
  - Jamming Margin, Jammer to signal ratio (JSR), processing gain,…etc with example
  - Performance of the un-coded system
  - Hard decision versus soft decision decoding
  - Derivation for the performance of SS under different jamming Conditions. See to examples 13.2-1 and 13.2-2
  - Performance under Pulsed Jamming (Partial Time Jamming)
    - Interleaving
    - Performance under different codes
- **Generation of PN Sequences**
  - Criteria:
    - Auto-correlation
    - Cross-correlation
  - Maximum Length Shift Register
  - Gold Sequences
  - Welsh Bound
  - Kasami Codes
- **Frequency Hopping (FH)**
  - Definition
  - Features
  - Slow Frequency Hopping (SFH) vs Fast Frequency Hoping (FFH)
  - Detection Procedure
  - Processing Gain
  - Performance of SFH in Jamming Environments
    - Broadband Jamming
    - Partial-band Jamming

- **Comparison FH vs. DS (7 points)**
- **CDMA Practical Example:** Forward and reverse link IS-95 (748-753)
- **CDMA vs. TDMA/FDMA :** Viterbi debating himself in three published papers**.**
- **Check Matlab for useful CDMA and SS codes**
