**Problem 5: Implementation for Practical Deployment in Wireless Systems**

1. List the key advantages of FPGA implementation over ASIC implementation for real-time decoding and signal processing implementation. (Consider cost, flexibility, design cycle and flexibility, etc.)

* They are more flexible since a wide range of applications can be done using FPGAs
* They have a faster design cycle
* A prototype can be done in real time

1. List the key advantages that an ASIC implementation has over FPGA implementation of a real-time signal processing algorithm.
   * ASIC chips are smaller than FPGAs
   * They are four times more energy efficient
   * Any special purpose hardware can be added, depending on the application
2. Have FPGA-based signal processing hardware been deployed in satellites and deep space probes? Explain why not. For cellular phone systems (mobile and base station units), where are FPGA’s mostly deployed and where are ASIC’s needed. Provide a reference for your answer.
   * Not a lot due to their sensitivity to involuntary reconfiguration due to Single Event Upsets (SEU) induced by radiation. A single event upset is a change of state caused by a high-energy particle strike to a micro-electronic device. [1]
   * FPGAs are mostly deployed for wireless base-station connectivity networks [2] [3]
   * ASICs are mostly deployed on mobile. [2][3]

[1]"The use of reprogrammable FPGAs in space", *European Space Agency*, 2018. [Online]. Available: http://www.esa.int/Our\_Activities/Space\_Engineering\_Technology/Microelectronics/The\_use\_of\_reprogrammable\_FPGAs\_in\_space. [Accessed: 11- Feb- 2018].

[2] “The Application of FPGAs for Wireless Base-Station Connectivity”, *Xillinx,* 2015. [Online]. Available: https://pdfs.semanticscholar.org/4d0c/a120b333ab73c45e2d04352119e1f949b975.pdf. [Accessed: 11- Feb- 2018]

[3] M. DeGrasse, "Ericsson and IBM announce 5G base station chip", *RCR Wireless News*, 2018. [Online]. Available: https://www.rcrwireless.com/20170207/chips/ericsson-and-ibm-announce-5g-base-station-chip-tag4. [Accessed: 11- Feb- 2018].