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**SYSE 5110**

**HW1**

**p 21: 1, 3, 4**

**p 52: 9, 12, 16**

1. Pick a system with which you are familiar and verify that it is indeed a system as per the system definition given at the beginning of section 1.1.

A personal computer is a system that meets the definition given in the text. It consists of elements or parts that are combined to form a functionally related whole. Some of the elements of this system are the components: motherboard, CPU, memory (RAM), human interface devices (keyboard, mouse, monitor), storage (disk drive), power supply, sound card, network card, graphics card, etc. This system has attributes which may be the speed of the system completing certain calculations, size constraints, architecture, thermal output, vibration tolerance. The relationships between components may best be represented by the motherboard which is engineered to ensure components operate together effectively to form a complete system. The motherboard contains interfaces responsible for linking the majority of the components together.

3. Pick a system that alters material and identify its structural components, operation components, and flow components.

An additive manufacturing system alters material and consists of structural components, operational components, and flow components. The structural components are the static parts of the a fused deposition modeling 3d printer. The frame, enclosure, and filament storage are the only static components on a typical FDM printer. The operational components are numerous. Some of the operational components are the power supply, heated bed, control board, extruder, stepper motors, thermistor, nozzle, cooling fans, etc. The flow components of a FDM printer include all three types listed in the text: material, energy, and information. The system processes and alters plastic (material) by changing it from a filament on a spool into an object of a completely different shape. Electricity (energy) is processed into motion by the motors and heat by the elements in the bed and nozzle. High level programming code (information) is processed into low level instructions by the control board for executing the operation of the system.

4. Select a complex system and discuss it in terms of the hierarchy of systems.

A cellular telecommunications system is certainly a complex system that consists of a hierarchy of subsystems and components. Additionally it can be broken down into smaller systems that have subsystems and components. A cellular network has many subsystems such as the radio base station subsystem, the core circuit switched network, the packet switched network, and the public switched telephone network. These subsystems combine to form the Global System for Mobile Communications (GSM). The radio base stations subsystem includes components the perform functions necessary to the operation of the subsystem. Some of these components are transceivers, antennas, encryption equipment, and the base station controller. Each of these components can be further decomposed into subsystems and components of their own. The Network switching subsystem is responsible for facilitating the roaming functionality of cellular phones. It ensures that data can be reliably be delivered to the phone while moving to a new base station. It consists of call out equipment and processing systems. Likewise, it can be further decomposed. The general packet radio service subsystem enables the transmission of packet oriented mobile data like internet and SMS messaging. This subsystem’s position in the GSM hierarchy is also relative because it has been integrated into the previously mentioned network switching subsystem. It may be considered a subsystem of that system or a subsystem of the GSM. The public switched telephone network (PSTN) is the network of all national and regional telephone networks. It is the global network of telephone communications. This subsystem of the GSM utilizes many physical components as opposed to some of the previous subsystems that were primarily data processing architectures. The PSTN components include telephone lines, fiber optic cables, microwave antenna, satellites, undersea cables, and switching centers. Some of these systems blur the boundaries set in the hierarchy of systems. Depending on the context, scope, and frame of reference, the hierarchy changes. The GSM is subsystem of PSTN if we are defining the global network as the system or the reverse if the GSM is the system being discussed.

9. What are some of the essential factors in engineering for product competitiveness? Why is product competitiveness important?

12. What is the full meaning of the phrase “designing for the life cycle”?

16. How are requirements related to technical performance measures? What is the remedy when requirements and TPMs are not in agreement?