Midterm DEN 423

Name _____

All questions are 3 points each.   Score (out of 105): _____

Systems

1. A system must have what? (circle the best answer)
   A) People
   B) Deliver a product
   C) Purposeful function to alter material, energy, or information

2. Systems Engineering may <u>NOT</u> be described as:
   A) A technologically-based interdisciplinary process
   B) Using a life-cycle-oriented thought process
   C) Bringing systems into being
   D) The integration of sub-assemblies that make up a product

3. Name an example for each of the following types of systems:

   - Natural transportation system: river system: **creeks, streams, lakes, deltas**

   - Human made transportation system: **Airlines**

   - A manufacturing system: **Automobile**

4. Pick an engineered system of systems and list three possible insights that would not be readily apparent by looking at the individual systems that make it up.

   - System of Systems: **Information Technology**

       Possible Insights (for improvement or conflict avoidance):
       - **Quantity and type of work people are doing**

       - **Power consumption**

       - **Productivity**

Engineered Systems

5. What is the first question to ask when starting to work on an Engineered System?

   What problem are we trying to solve?

6. What activity does the product life cycle begin with? (circle the best answer)

   a. Needs analysis

   b. Identification of a need

   c. Determine the requirements

   d. Assembling a team of subject matter experts

7. What activity does the product life cycle end with? (circle the best answer)

   a. Rewards and recognition of the team

   b. Product retirement, phase-out, disposal

   c. Retrospective to understand where improvements can be made in the next project

   d. Customer Support

8. Name the five elements of a System Map (order is not important)

   - **Title or name**

   - **Driver or control processes**

   - **Support processes**

   - **Core processes**

   - **Purpose**

Systems Requirements

9. What type of team would you assemble to create a problem description with quantitative measures and perform an analysis of the functions to be performed?

Cross-functional or integrated product team

10. Which is <u>NOT</u> the purpose of a Feasibility Analysis? (circle the best answer)

   a. Determine what technologies are available to solve the problem.

   b. Determine trade-offs between several solution alternatives.

   c. Recommend a preferred technical approach that will meet the functional requirement.

   d. Recommend specific hardware and software solutions that will meet the requirement.

11. Which is <u>NOT</u> the purpose of System Operational Requirements (circle the best answer)

   a. Provide a description of all of the functions required

   b. Provide operation scenarios, mission profiles, or customer use models

   c. Provide staffing and facility requirements

   d. Provide performance and environmental factors

12. What is the biggest challenge to solve within a System of Systems?

Interferences between systems, negative impact on other systems in the same environment, designing for inoperability

13. Technical Performance Measures are quantitative measures that must be met for the system to fulfill its mission. Name two primary areas in the systems engineering process that TPMs are used:

- **Input to the design**

- **Used for evaluating design compliance**

o **Design criteria**

o **Design dependent parameters (DDPs)**

Design Requirements

14. What are the three inherent benefits of a specification tree? (aka documentation tree)

- **Coverage: ensures all system design requirements are covered**

- **traceability**

- **hierarchical**

15. Which is **NOT** true of the Requirements allocations process?

a. **Metrics needed at this point do not include human factors, physical features, producibility and supportability, sustainability and disposability**
see page 110

b. There is a top-down/bottom-up "traceability" of requirements throughout the overall hierarchical structure

c. The TPMs allocated for subassemblies/systems are consistent with the performance expectations of the overall system

d. Requirements allocation is preceded by the functional analysis

16. Which is representative of the Make-versus-Buy Decision (circle the best answer)

    a. Usually decided at the higher levels of the company based on corporate strategy.

    b. **Analysis focused on cost but includes quality, intellectual property risk, capacity, and delivery.**

    c. Synonymous with "outsourcing".

    d. It is usually best for the company to make its own parts.

Configuration Management

17. The "product" of engineering is   **documentation**

18. The purpose of a prototype is to   **prove the documentation**

19. Name three of the benefits of having good engineering documentation?

    - **Communication consistency**

    - **Common and standard description of the system**

    o **Tracking changes**

    o **Quality measurement**

    o **Reduce effort for regulatory compliance**

    o **Faster information retrieval**

20. Provide three technological areas where engineering has provided significant contributions that greatly benefited society. Provide an example of each.

    - **Medical: devices for disability, dialysis, CAT system**

    - **Transportation: cars, airplanes**

    - **Housing: low cost, functional shelters**

21. In configuration management terms, what is a "baseline"?

Agreed upon characteristics and descript at a point in time. Basis for defining change.

All of the specs necessary to describe a product

22. Name three categories of engineering drawings that might be needed to describe a single subassembly.

- **Schematic**

- **Functional diagram**

o **Mechanical drawings**

o **Inspection drawings**

o **Bill of Materials**

See p. 138, figure 5.6

23. What is the primary purpose of a Change Control Board? (circle the best answer)

a. Propose new engineering changes

b. **Evaluate impact of engineering changes**

c. Approve engineering changes

d. To drive continuous improvement through change

24. The challenge of mass customization is to build products crafted and tailored to the customer at the scale and cost of single item mass production. Name the three most common types of customization?

- Make-to- **STOCK**

- Assemble-to- **ORDER**

- Make-to- **ORDER**

25. Provide a (product) example of each common type of customization from above.

- **Coffee cups**

- **Dell computers**

- **Restaurant food**

System Evaluation

26. The prime objective of data collection, analysis, reporting, and feedback is to provide information in the right:

- **time**

- **location**

- **cost**

- **format**

  see Quiz 6.1, HW 6.10

27. Name four of the items unique to the supply chain which should be evaluated for system success?

- **Packaging/handling**

- **transportation**

- **distribution**

- **procurement**

  see chapter 6 question 2, HW 6.12

28. What formal processes should be monitored by the Systems Engineer to ensure a fix for a noncompliance issue discovered during System Evaluation testing? (circle the best answer)

   a. **Initiate Corrective Action followed by an Engineering Change**

b. Negotiate for a change in requirements if needed to keep the program on track

c. Assign an experienced engineer fix the problem.

Configuration Management

29. If a System Design change is needed, what are the possible areas impacted? (circle the best answer)

a. Product functionality

b. Installation and repair manuals

c. Finding and reworking existing stock

d. Customer Support

e. Regulatory compliance and environmental impact

f. All of the above

30. Why is tight control of configuration management especially important during system testing?

To know what is being tested.

Comparable results for different tests.

31. How should a Systems Engineer define a successful testing outcome? (circle the best answer)

a. Zero defects detected is always the goal.

b. Uncovering an extensive array of failures exposing weaknesses in multiple parts of the system.

c. Some failures found at extreme conditions but easily addressed in a short amount of time.

Human Factors

32. Name the four categories of Human Factors.

- **Anthropometric**

- **Sensory**

- **Physiology**

- **Psychology**

33. In addition to user safety, what is another goal for understanding Human Factors Elements in a system?

- **Error reduction, efficiency/productivity**

34. What percentage of the male population is RED/GREEN color blind? (circle the best answer.)

a. 0.4%

b. 4%

c. 8%

d. 16%

35. Assume your target population is composed of 70% men and 30% women. The system requirements state that the system must work with a 95 percentile of the population. Should you consider color blindness in your Human Factors criteria? (circle the correct answer)

True

False