

SEN4991 Capstone Midterm Questions & Answers

Topic 1: Management

Which view of conflict states that "conflict can be a positive force necessary for a group to perform effectively"?

interactionist view of conflict

Which of the following terms indicates the tendency of individuals to spend less effort when working collectively?

social loafing

Which of the following is not one of the characteristics of project objectives?

Group Objectives are SMART: Specific, Measurable, Achievable, Relevant, Timely

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is not an objective for the success of a project?

Objectives for the success of a project are:

- completion on time
- within budget
- effectively utilized resources
- desired performance
- satisfaction of stakeholders

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

The lowest level in the hierarchical breakdown of the Work Breakdown Structure is

work packages

Which of the follow is not a tool used for project management?

Tools used for project management are:

- Work Breakdown Structure (WBS)
- Responsibility Matrix (RM)
- Project Network (PN)
- Gantt Chart (GC)

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following best explains the term "synergy"?

Synergy (1+1+1+1+1=6)

the combined effect of the collaboration is greater than the sum of individual parts

Which of the following does not encourage cohesiveness within a team?

Cohesiveness can be encouraged by:

- Making the team smaller
- Encouraging agreement with team goals
- Increasing the time that members spend together
- Emphasizing the importance of the team and its goals
- Stimulating competition with other teams
- Giving rewards to the team rather than to individual members
- Physically isolating the team

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is not an attribute of a project?

A project has the following attributes:

- has clear objectives
- has a definite duration
- involves activities
- uses resources
- is unique, not same as any other
- has stakeholders

- may involve risk and uncertainties

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Project management techniques are applied to avoid project failures by:

- improving the overall project performance
 - improving quality
 - improving communication
 - reducing the required time
 - reducing risks
 - providing standard methodologies
 - providing accurate reporting and documentation
-
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Which of the following best defines the Project Network?

Project Network (PN) shows the chronological order and dependencies between activities and include integration and testing activities

Which of the following best defines the Work Breakdown Structure?

The hierarchical division of work into smaller elements

- provides a map of the project
- establishes a basis of control
- is task and deliverable-oriented and top-down

Topic 2: Engineering Design

Which of the following best defines the "quality" of a product, service or process?

Quality means fitness for use

- **Features**
 - what does the product do?
 - **Performance**
 - how well does the product perform the intended function?
 - **Reliability**
 - can the product perform its function repeatedly?
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Which of the following is *not* a step in the design process?

design process can be broken down into a number for steps:

1. Identification of the need
2. Definition of the problem
3. Research the field
4. Conceptualization
5. Synthesis into a physical architecture
6. Materialization and optimization
7. Evaluation (verification and validation)
8. Presentation to stakeholders

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is *least* important for a designer?

???

Which of the follow best defines "risk"?

potential for failure / potential failure in a project

Which of the following best defines "factor of safety"?

the ratio of the actual performance to the required performance

Which of the following best defines "design"?

Design is a highly iterative and innovative process. A number of solutions should be considered and the 'best' chosen for prototyping.

Which of the following is an important design consideration?

budget, time, standards, legal, economic, environmental, sustainability, manufacturability, conformability, aesthetics, safety, marketability, ethical, health, safety, socio-political

are all important considerations during the design process

Which of the following best describes the "Identification" and "Definition" steps of the design process?

Identification:

Design begins with the identification of the need for a product or service. Ask yourself, what engineering problem needs to be solved? what product or service needs to be developed?

Innovation plays an important role here. An innovation can provide an incremental improvement in an existing product, or it can lead to a completely new product that creates an entirely new market (see Topic 5).

Definition:

Once the need has been identified, a technical definition of the problem is stated in terms of specifications of the product or service.

- feature and performance requirements;
- objectives (see the SMART requirement for objectives);
- engineering constraints.

Which of the following best describes the "Research" and "Conceptualization" steps of the design process?

Research:

Usually, similar products or services will already exist in the market. Identify similar design solutions that already exist, investigate relevant technologies and methods.

During this step, the designer should also investigate broader design constraints placed on your product due to legal, ethical, sustainability (etc) considerations. Standards, set by the relevant profession, should also be noted.

Conceptualization:

Conceptual solutions are imagined, discussed and compared. The designer will prepare a number of different conceptual solutions that will satisfy requirements and constraints differently.

At this early stage of the project it is important to find solutions that minimize costs and risks, and maximize the potential for quality.

Which of the following best describes the "Synthesis" and "Materialization" steps of the design process?

Synthesis:

In the synthesis step, a conceptual solution is decomposed into a physical architecture (a set of objects that represent actual components). The architecture can be mathematically modelled and/or prototyped. A number of conceptual solutions should be considered and compared and the best one chosen for the next step.

Materialization:

The chosen physical architecture is ready to be transformed into a material form, that is a physical prototype. This will be an iterative process where the architecture, components and manufacturing methods are optimized to obtain a system that best meets the product specifications.

Which of the following best describes the "Evaluation" and "Presentation" steps of the design process?

Evaluation:

The completed prototype is thoroughly tested to obtain objective proof that the product performs according to the design specifications (verification) and satisfies user requirements (validation).

This step requires testing the product under normal operation conditions and any likely extreme conditions.

Presentation:

The final step is to present the product to stakeholders (supervisors, managers, manufacturers, clients) in an effective way to give proof that the solution is successful. In a commercial setting for example this will determine whether the product goes on to be manufactured for sale. Presentation includes all kinds of communication including detailed documentation of evaluation, and user manuals.

Topic 3: Constraints

Which of the following best defines an "engineering constraint"?

Anything that limits the designer's freedom of choice is a constraint.

Engineering constraints is expanded further introducing very briefly the subjects of ethics, standards, security and privacy, environment and sustainability, safety, legal, social and political.

Which of the following is *not* one of the four moral theories of ethical thinking?

Four moral theories of ethical thinking are:

- **Utilitarianism**
 - in this view, a right choice is one which gives maximum benefit to society as a whole
- **Duty ethics**
 - in this view, a right choice is one that follows ethical rules

- **Rights ethics**
 - in this view, a right choice is one that respects the rights of the individual person
- **Virtue ethics**
 - in this view, a right choice is one that supports good character traits (responsibility, honesty, competence, loyalty, trustworthiness, fairness, respect)

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following has the *lowest* importance in maximizing the safety of a product?

Safety is maximized by eliminating hazards as much as possible and minimizing the risk from any that remain

to help maximise the safety of a product, five steps must be followed:

1. Comply with the law.
2. Follow current engineering standards.
3. Consider alternative designs.
4. Foresee potential misuse of the product.
5. Test the product.

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is *not* one of the steps to ensure sustainable design?

five steps to sustainability in the design process are:

1. Refer to the laws provided on the national and international level.

2. Refer to the environmental standards set by your profession. These will often go beyond the standards set by law.
3. Seek advice from other professionals; such as biologists, public health experts and professional environmentalists.
4. Choose materials that are less harmful to the environment, especially materials that are recyclable.
5. Consider alternative environmentally-friendly designs and processes and adopt them as much as possible.

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is *not* a cyber security objective?

six cyber security objectives are:

- **Confidentiality**
 - unauthorized users cannot read information
 - e.g., your medical records cannot be read by your friends.
- **Integrity**
 - unauthorized users cannot alter information
 - e.g., the balance of your bank account cannot be changed by unauthorized persons.
- **Authentication**
 - knowing who is interacting with the system
 - e.g., you use a passcode to unlock your smart phone.
- **Availability**
 - authorized users can access the relevant information when needed
 - e.g., an ATM machine should be able to handle requests 7/24.
- **Privacy**

- complying with the law when collecting, storing, using and sharing data
 - e.g., a mobile application should not track users' locations when they're not using the application.
- **Anonymity**
 - the identity of the participant or the data point is not known
 - e.g., you do not ask the name of the participants for a survey.

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

What can the engineer do to improve the social impact of their work?

There is an increasing demand on engineers to understand the social impacts of products, services and processes and integrate this understanding into the design process. While engineers are commonly expected to work in technically multidisciplinary teams, they also need to work with communities to learn more about their needs and how products and services affect them.

Professional engineers and the professional organizations that represent them also have an important role in { policy making }. Engineers are consulted by companies, local authorities and law-makers. As standards of professional organizations develop, these standards often become the minimal-standard expressed by law.

Engineers have an important role as leaders in society, they need to continuously educate themselves in the latest laws and practices of their profession and actively seek out to improve practices and policies in society.

Which of the following is *not* true for a "standard"?

all of the following below describe a standard:

- A standard is a document that defines the characteristics that must be met by the products, systems and processes that the standard covers
- Standards attempt to ensure that products and services are consistent, compatible and safe
- Standards are a communication tool that allows all users to speak the same language
- They provide a "legal," or at least enforceable, means to evaluate acceptability and sale-ability of products and services
- They can be taught and applied globally
- are designed to protect society from poor designs, products and practices
- help engineers to meet environmental, health, safety and societal responsibilities

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is *not* true for a "law"?

all of the following below describe a law:

- A law is a formalized code of conduct that is enforced through social or governmental institutions
- Laws reflect what society accepts as the norms of behavior
- Law will tell you what you can and cannot do
 - (ethics, instead, answer what you should or shouldn't do)
- Laws tend to provide and enforce minimal standards of society
- The engineer must always abide by the law, but also hold themselves to higher standards
 - This can be very challenging for the engineer since they operate in environments that are often hostile to their ethical obligations

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which of the following is *not* a principal source for a standard?

four principal sources for standards are: (for classification of standards by origin)

- Company standards
 - Trade associations and professional society standards
 - Government standards
 - Consortia standards
 - De facto (ad hoc) standards
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Which of the following best defines "safety"?

The professional engineer has the responsibility to place public safety and interest above all other considerations. The need for a product, process or service to be safe is therefore a major constraint in design.

Safety is maximized by eliminating hazards as much as possible and minimizing the risk from any that remain.

Which of the follow classifications of standards provides the widest scope?

International

In addition, standards can be classified by their scope:

- National (applied within a country)
- Regional (applied to a collection of regional countries)
- International such as

- ##### International Organization for Standardization (ISO)
 - ##### International Electrotechnical Commission (IEC)
 - ##### International Telecommunication Union (ITU)
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Which of the following best defines "cyber security"?

Cyber security is the protection of information systems, including both hardware and software, from theft, unauthorized access, information disclosure, and intentional harm.

Topic 4: Measurement and Verification

Which of the following best defines "verification"?

"are we building the product right?"

This is the evaluation of whether the product conforms to the design specifications; that is the product satisfies the functional and performance requirements defined during the product definition step. This is often a highly iterative process and is applied during the development of the sub-systems as well as to the completed product.

that the product, service or process performs according to the design specifications

requires testing the product in the laboratory under expected operation conditions and any likely extreme conditions

(capstone) includes measurement and data analysis

Which of the following best defines "validation"?

"are we building the right product?"

Here we are ensuring that the system satisfies the requirements of the stakeholders (e.g customers) in its intended environment. This may require testing the product in the intended environment and interacting with the user. Failure at this stage may require the designer to return to much earlier steps of the design process.

that the product satisfies user requirements (validation)

In the verification process, which of the following is *not* an example of a "functional objective"?

Functional/feature requirements

Identify each feature and demonstrate that they are present in the product. This will require a written account of test runs.

In the verification process, which of the following is *not* an example of a "performance objective"?

Performance

Identify each performance objective and design experiments for the collection and analysis of relevant data. This will be the focus of this lecture.

Which of the following has the *lowest* importance in the design of a verification experiment?

Could not infer a certain answer for this, yet context for this is provided below:

Statistical tests require data which needs to be collected by performing appropriate experiments. Experimentation requires the selection of appropriate measurement tools, and careful control of the inputs

- User Input
 - Environmental Input
 - Output
 - Measurement
 - Analysis
 - Presentation
-
-

Which of the following is *not* related to statistical analysis?

Systems are complex and often exhibit significant variability. Output variability can be caused by random variations in inputs, environment, or within the product itself. Measurement instruments may also exhibit random variation.

Random variations in the:

- inputs
- environment
- internal process
- measuring device
- output

Variability gives rise to **uncertainty** in the measured performance. To quantify variability in the system, the engineer needs to perform **repeated measurements** (sampling) under controlled operating conditions, and then perform **statistical analysis**. It is important to note that statistical uncertainty reduces with larger sample sizes; try to

plan the experiment to maximise the amount of data that you can collect in the available time

Often we need to ask two main questions:

- What is the range of performances
 - THAT WE CAN EXPECT FROM THE PRODUCT UNDER NORMAL WORKING CONDITIONS,
 - AND DOES THIS SATISFY ANY TOLERANCES (THE PERMISSIBLE LIMITS OF VARIATION)?
 - What is the average performance (expectation) of the product,
 - AND DOES THIS SATISFY THE REQUIREMENTS?
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Which of the following is *not* an example of an environmental input?

ESSENTIALLY ANYTHING WHICH IS NOT AN INDIRECT INFLUENCE, OR SOMETHING WHICH IS A USER INPUT

Which of the following is *not* an example of a user input?

ESSENTIALLY SOMETHING WHICH ONLY INDIRECTLY INFLUENCES THE OUTPUT, AN ENVIRONMENTAL FACTOR

Which of the following will reduce statistical uncertainty in a verification experiment?

To quantify variability in the system, the engineer needs to perform

- repeated measurements (sampling) under controlled operating conditions,
- and then perform statistical analysis.

It is important to note that statistical uncertainty reduces with larger sample sizes; try to plan the experiment to maximise the amount of data that you can collect in the available time.

The mean of a collection of repeated measurements is a measure of:

could not find a specific corresponding answer to this question

With respect to verification, which of the following best describes the term "tolerance"?

permissible limits of variation

The efficiency E of a process is determined to be in the interval $0.81 < E < 0.93$ with a 95% confidence. That is:

this could either ask for a confidence interval/level, or a specific H_0 or H_A σ value

Topic 5: Innovation

Innovation = ?

Innovation = Invention + Commercialization

Which of the following is considered as an attribute of creative thinking?

Which of the following is *not* an attribute of creative thinking?

attributes to creative thinking:

- **flexibility**
 - willing to look at an issue from many angles, not set in our ways
 - **originality**
 - attempts to find non-typical responses to problems
 - **Non-judgmental**
 - not rejecting a potential solution without giving it appropriate consideration
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Which of the following is *not* one of the stages of the creative process?

the four stages of the creative process:

1. Preparation

- gather information about the problem and focus your mind on it

2. Incubation

- the conscious mind stop focusing on the problem to allow it to internalized into the unconscious and form connections between ideas

3. Illumination

- the conscious mind becomes aware of potential solutions

4. Verification

- the solution is developed, and consciously verified and applied
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What is the starting point of innovative ideas?

Creative people don't just sit waiting for the "lightbulb moment", they approach a problem systematically

"When an enterprise produces a good or service or uses a method or input that is new to it, it makes a technical change. The first company to make a given technical change is an innovator. Its action is innovation."

It is the creativity of an entrepreneur that results in invention (creation of new knowledge) and innovation (application of knowledge) to create new products, services or processes.

According to the UK government, "innovation is the process by which new ideas are successfully exploited to create economic, social and environmental value" (BIS 2014, p.7).

In the mid-twentieth century, economist Joseph Schumpeter (1950) pioneered the categorisation of innovation as the creation of something 'new' that creates and adds value for those who interact with, or consume, it. Something 'new' can also mean the updating of something which already exists in order to take advantage of a specific segment or a newly-identified or emerging market.

Which of the following is *not* one of the barriers of creativity?

barriers creativity:

1. searching for the one 'right' answer

2. focusing on being logical
3. blindly following the rules
4. constantly being practical
5. viewing play as frivolous
6. becoming overly specialised
7. avoiding ambiguity
8. fearing looking foolish
9. fearing mistakes and failure
10. believing that 'I'm not creative'

ANY OPTION OTHER THAN THOSE WOULD BE THE CORRECT ANSWER

Which type of innovation involves improvements to existing products, processes or markets?

Sustaining innovations

are best thought of as improvements to existing products, processes or markets.

EXAMPLE: DESKTOP TO LAPTOP COMPUTERS

Which type of innovation creates new markets?

Disruptive innovations

create new markets. In such instances, individuals or business organizations take inventions and transform them into economic innovations. Existing market structure is changed.

EXAMPLE: FROM "NORMAL" PHONES TO "SMART PHONES"

What types of works are protected by copyright?

Copyright is the exclusive right given to the creator of a creative work to reproduce the work. The creative work may be in a literary, artistic, educational, or musical form.

What type of intellectual property can be used to protect the Nike "swoosh" symbol?

Trademarks and Service Marks

If a company develops a new technology that improves its main product, what type of intellectual property can they use to stop others from copying their invention?

Patent

What type of intellectual property can be used to protect internal information that belongs to a business?

Trade Secrets

four distinct types of innovation can be defined as:

Invention - described as the creation of a new product, service or process

Extension - the expansion of a product, service or process

Duplication - defined as replication of an already existing product, service or process

Synthesis - the combination of existing concepts and factors into a new formulation

Patents, trademarks, copyrights and trade secrets protect intellectual property

Patents

protect new, useful, and non-obvious inventions (ideas).

An invention can be, for example, a product, service or process.

Trademarks

protect source identifications, usually for brands, slogans, logos, or designs.

Copyright

is the exclusive right given to the creator of a creative work to reproduce the work. The creative work may be in a literary, artistic, educational, or musical form.

Trade secrets

protect valuable secret information, usually belonging to a business and unknown to others.
