

University of Toronto
Faculty of Applied Science and Engineering
APS111 & APS113 Engineering Strategies and Practice
Lecture Sections 01 & 02
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Midterm Examination
November 8, 2018
7:20 pm to 8:30 pm

Instructions:

- This is a 70 minute midterm with 35 questions.
- It is a multiple choice midterm and is closed book.
- No aids are permitted.
- Read each question thoroughly and provide the answer on the answer sheet.
- Select the answer that best satisfies the question.
- Be sure to fill out the answer sheet clearly with no overlaps.
- Fill out the answer sheet using a pencil. Erase any errors completely.
- Provide only 1 answer per question
- Each correct answer is worth 1 mark. There is no deduction for wrong answers.
- You may tear off the appendix to ease the answering of questions.
- You are not required to hand in this exam question booklet; you are required to hand in the answer sheet.

1. In his interview, James Teh, accessibility engineer for Mozilla, states that an ideal outcome for accessible interface design would be “that the semantic has been communicated.” In the context of the Tanvas project, what Objective best captures that outcome?
 - a. The user should understand the information provided by the haptic feedback.
 - b. The semantic meaning provided by the app should be clear.
 - c. The app should clearly communicate the users’ desired haptic-semantic meaning.
 - d. The haptic feedback should be clearly connected to the operations of the app.
2. Which is a recognized principle of Universal Design?
 - a. Tolerance for error
 - b. Adherence to applicable design standards
 - c. Creating a custom design targeting the needs of a specific user group
 - d. None of the above
3. What is the difference between a Client Statement and a Problem Statement?
 - a. There is no difference. They are synonyms for the document that is the input into the Design Brief.
 - b. The Client Statement is written with the Client’s needs in mind, whereas the Problem Statement is written with the Client’s wants in mind.
 - c. A Problem Statement is used as a source to write the Client Statement.
 - d. A Client Statement often contains implied solutions, whereas a Problem Statement must be solution independent.
4. If a client requests, “a bag that attaches to my wheelchair so I can carry groceries home from the store easier,” what is an acceptable underlying statement of need.
 - a. The client needs a means to get groceries home.
 - b. The client needs a means of securely attaching things to their wheelchair.
 - c. The client needs a bag for transporting groceries.
 - d. All of the above.
5. Which would have been an appropriate question to ask Ed Colgate in a client interview?
 - a. Is Tanvas required to adhere to the Americans with Disabilities Act?
 - b. Can you explain Universal Design principles?
 - c. What inspired you to create Tanvas?
 - d. What are some technical limitations of the Tanvas hardware?

6. Secondary functions are:
 - a. Functions that are designed after the Primary Functions are done.
 - b. Less important than the Primary Functions.
 - c. Functions that enable the Primary Functions.
 - d. More like Objectives than Primary Functions because they have measurable goals.
7. One of the requirements of Objectives is that they be testable; to do this before the CDS you have to:
 - a. Determine measurable Objectives that allow you to calculate or estimate.
 - b. Create prototypes for all possible solutions.
 - c. Use surveys of people you know to test your ideas.
 - d. Find the most dramatic figurative language to sell your design.
8. A thorough Team Charter is critical to the success of a team because it:
 - a. Enforces team rules.
 - b. Is a tool for communicating and negotiating team expectations.
 - c. Keeps team member from getting away with being late.
 - d. Ensures all team members meet a minimum level of technical competency.
9. According to Google, which factor best predicts team success among its employees?
 - a. The intelligence of team members.
 - b. The level of experience with the subject.
 - c. A sense of comfort and security with a team.
 - d. The personalities of the team members.
10. A good Service Environment description:
 - a. Allows the team to create a more complete set of requirements.
 - b. Adds new requirements that are not in the functions, objectives, or constraints sections.
 - c. Allows the team to organize the requirements more efficiently.
 - d. Effectively explains how the design will operate in the environment for which it was designed.
11. The sections of a Project Requirements serve the following purpose:
 - a. To create excitement about the design.
 - b. To set a target everyone can work toward.
 - c. To accumulate as much information as possible.
 - d. To repeat back to the client exactly what is in the client statement.

12. SpaceX is planning to use its interplanetary spacecraft for travel around the earth, promising flight time as a fraction of what it is today – e.g. New York to Shanghai in 39 minutes. One stakeholder for this project would be:

- a. Travellers who use the system.
- b. Navigators who determine flight paths.
- c. Astropilots who fly the craft.
- d. People who fish near the aquatic landing pads.

13. When ideating for a project, it is best to:

- a. Pick one method to use that you think best suits the project.
- b. Use two methods so you can check the solution ideas you got using the first method by using the second one.
- c. Use a variety of the methods to try to get a wide variety of possible solutions.
- d. Use every method possible to show your client that you have all the possible solutions.

14. Your design team has been tasked with revolutionizing the backpack industry.

During the ideation process you notice a trend that all your proposed designs center around having a portable power bank for charging devices. You want your team to consider different design approaches so you propose creating a temporary ban on batteries when generating new ideas. This is an example of which creativity method?

- a. SCAMPER
- b. Design Heuristics Cards
- c. Morph Charts
- d. Analogy

15. The class activity on storyboarding was used to provide an opportunity:

- a. To practice a method used frequently in industry for visioning and design.
- b. To create the design solution that you will recommend in your CDS.
- c. To create a prototype that you will use to test a design idea.
- d. For a fun activity to build teamwork.

16. After doing the storyboarding activity in class, your team should:

- a. Take the design ideas from class and put them in your CDS.
- b. Combine the ideas from class and others you have generated to put in your CDS.
- c. Create prototypes for all of the ideas you have generated for your design project.
- d. Create some other user stories and pick some of them to prototype using different design ideas.

17. Of the following, which is the biggest obstacle to Critical Thinking for ESP students?

- a. Too much texting and time on the internet.
- b. Awareness of their own values and bias.
- c. The belief that there is a correct answer.
- d. The second law of thermo-dynamics.

18. To make a sentence quick to understand, place the verb:

- a. As the first word of the sentence.
- b. At the end of the sentence.
- c. Near the middle of the sentence.
- d. As close to the start of the sentence as possible.

19. Your team has chosen a weather app for the Tanvas Project. One example of Scope Creep would be:

- a. Make clothing recommendations based on the daily weather forecast.
- b. Allow the user to pick a location other than where they are.
- c. Texture the tablet surface to represent different weather conditions.
- d. Transmit information about the weather that is forecast later in the day.

20. What best describes an Executive Summary?

- a. It describes the problem.
- b. It introduces the document.
- c. It is a stand-alone document.
- d. It should be written first.

21. At what point in the Design process should stakeholder interests be considered?

- a. Framing the problem, determining requirements
- b. Solving the problem, designing solutions
- c. Implementing the solution
- d. All the above

Questions 22 to 35 pertain to the RFP - The Ultimate Student Jacket Challenge located in the appendix of this booklet.

22. The best description of the Functional Basis for this design project is:

- a. Maintain moisture and store heat energy
- b. Maintain heat energy and sense temperature and moisture levels
- c. Control the transfer of moisture and maintain heat energy
- d. Combine energy and keep the user dry

23. For the given RFP, the best introduction to a Project Requirements would be:
- a. We are an ESP team commissioned by our client, a top-notch new outer-wear maker, to create a dazzling line of new outer wear for people in the 18 to 80 age range. With extensive research, we promise to come up with the ideal solution.
 - b. Our client, *Legion of the Toque*, a new outer-wear company based in Toronto is looking for a design for a coat that would be suitable for the range of local weather conditions. The following report provides a foundation for our design process, including the conditions the outer wear must withstand as well as considerations that balance function and fashion.
 - c. Our client, a fledgling outer wear company based in garment district of Toronto, Canada called *Legion of the Toque* is looking to take the garment industry by storm by refusing to adhere to the expected categories of clothing.
 - d. Weather in the GTA can be truly horrible with temperatures recorded as low as -31°C and as high as +38°C (www.currentresults.com), an average 130 cm of snow, but a record of 207.4 in 1937-38 (National Post). Our client, *Legion of the Toque*, has asked our ESP team to design a coat for all occasions and all kinds of weather.
24. For the given RFP, the best introduction to the Detailed Requirements section would be:
- a. In order to come up with a design that has a high WOW factor, our team has used the black box method (see Appendix T) to arrive at the following functions, objectives and constraints.
 - b. The following section contains the functions of the design (what the design should *do*), the objectives (what the design should *be*), and the constraints (what the design *must be*).
 - c. The scope of this project is to manage comfort in a coat. Comfort occurs when a coat is warm at -40°C but cool at +10°C. It must also look good so that people want to buy it.
 - d. In considering a garment that would be comfortable at +10°C and also warm at -40°C, our team has decided to focus on finding a system that would transform thermal energy and remain wearable.
25. For the given RFP, Line 42 most likely contains a(n):
- a. Functions
 - b. Constraint
 - c. Objective
 - d. Implied solution

26. For the given RFP, Line 48 most likely contains a(n):
- Functions
 - Constraint
 - Objective
 - Implied solution
27. For the given RFP, which line most likely contains a measurable Objective?
- Line 47
 - Line 48
 - Line 49
 - Line 52
28. The Environment Canada website indicates that Toronto can experience -32.8°C for a daily high in January, and up to 40.6°C in July. For the given RFP, which would be the best point to include in the Service Environment section?
- The daily high temperature in Toronto in January can be a low as -32.8°C.
 - The maximum high temperature in Toronto in July is 40.6°C.
 - The temperature in Toronto has a range of over 70°C from the highest temperature in the summer to the lowest in the winter.
 - The design should keep the user warm down to at least -32.8°C.
29. For the given RFP, which line most likely contains an Objective Goal?
- Line 46
 - Line 47
 - Line 48
 - Line 49
30. For the given RFP, Line 19 is most likely a(n):
- Fact
 - Opinion
 - Option
 - Claim
31. Considering the given RFP, a team member with Critical Thinking Ability, would consider the requirement of “a high WOW factor” and, at the client meeting:
- Assure the client that the team would do its utmost to satisfy that objective.
 - Tell the client that figurative language is not permitted and so that objective would not be addressed.
 - Ask the client to explain that idea in order to find its measurable components.
 - Say nothing to the client and ignore the suggested objective as “solution driven.”

32. For the given RFP, which of the following should **NOT** be listed as Stakeholders, even though they have an interest, or stake, in the project?

- a. The Design Team
- b. Legion of the Toque
- c. UofT Engineering Students
- d. All of the above

33. For the given RFP, a Stakeholder would be:

- a. Other coat manufacturers in the GTA.
- b. Dry-cleaning companies.
- c. People who buy coats.
- d. Fashion magazines.

34. A good approach to Benchmarking for this project would be:

- a. Look at the winter coat you own and analyze what changes you might make to it to better fit your needs.
- b. Go to a variety of stores or websites that sell outerwear and collect data on the coats that are currently available.
- c. Watch someone using a coat in winter. Record the steps they take when storing the coat in a locker, putting it on, and what they put in the pockets.
- d. Identify the inputs and outputs related to a coat. Record the information, energy and mass that go into and out of a coat when it is being used.

35. For the given RFP, the best introduction to a Stakeholders section would be:

- a. The design has to take into consideration the entire life-cycle of the garment, from the gathering of its raw materials, through manufacture, useful life and final disposal. The following is a list of people or organizations who may be involved at any step in this process.
- b. Stakeholders are people or organizations who are interested in the design. The following list is in order of importance.
- c. The following list in order of importance shows stakeholders, who are people or organizations who have a stake in the design. The stake may be economical, physical or psychological.
- d. Stakeholders include any group of people who will be affected by the project. A stakeholder's interest is defined as the aspect of the stakeholder which will be affected by the design. Interest implies that there may be a gain or loss to the specific stakeholder. Rankings for stakeholders can be found in Appendix B.

End of questions that pertain to the RFP – The Ultimate Student Jacket Challenge located in the appendix of this booklet.
There are no questions beyond this point

Appendix A: RFP: The Ultimate Student Jacket Challenge

Overview

Your days spent as a student are nothing like your parents' days, so why do you use the same jacket? Running between classes through crowded hallways and sprinting jacket-less from building to building. Lugging textbooks, laptop, tablet, and phone around and trying to keep them charged. Cramming everything into a locker. Power napping on the commute. Searching for that pen you just had a minute ago. Arriving for classes when it's bright, sunny and warm... leaving when it is dark, cold and sleeting. No jacket out there meets your needs...yet. The Ultimate Student Jacket Challenge aims to find a jacket design that meets the needs of the modern UoT Engineering student.



There are all sorts of jacket designs out there, but they are all focused on form rather than function. A UoT engineering student is resilient, efficient and a multitasker, they need a jacket that keeps up with them. You are to design that jacket.

The Current Situation

Current jackets on the market usually fall into one of several categories:

- Extremely warm but are so bulky that they are hard to wear under a backpack and forget about stuffing it into a locker.
- More fashion than function.
 - Who makes jackets without pockets? Or worse made with pockets so small that your phone falls out as soon as you raise your arm to grab the streetcar handle.
 - Look great but do not keep you warm.
- Extremely portable but leave you frozen as soon as fall arrives.
- Toasty warm until the first freezing rain and suddenly you are soaked to the bone and your phone shorts out.

Who We Are

We are a fledgling outer wear company based in garment district of Toronto, Canada called *Legion of the Toque*. We are looking to take the garment industry by storm by refusing to adhere to the expected categories of clothing. For example, why can a fashionable jacket not be warm?!

38 **The Challenge**

39 Design a jacket that:

- 40 • is wearable in all weather
41 • Keeps you warm in -40°C [1], but not too warm to wear in 10°C.
42 • Waterproof: Minimum rating of 10 Psi, so can be called moderately waterproof [2],
43 though the more waterproof the better. NOTE: Don't forget that wet goose down is a
44 terrible insulator.
45 • Is appropriate for light activity such as running to catch the streetcar with an air
46 permeability of 8,000g/m²/24h [3].
47 • Is windproof.
48 • the battery must be at least 20,000 mA·h [4].
49 • is environmentally friendly.
50 • is equal or better in cost compared to the cost of a high-end winter coat.
51 • has a carrying capacity of 7kg and 5L.
52 • packable to less than 4L volume (without contents of the pockets)

53 **We are looking for ideas that**

- 54 • have a high *WOW-factor*: "Consumers would do anything to get such a product"
55 • we are legally able to sell in Canada. "We have limited funds and don't want to spend it paying
56 royalties to a patent holder."
57 • have a high *FEASIBILITY-factor*: "A solution that can be implemented with current technology."
58 • look like a jacket. This is NOT called the Ultimate Giant Inflatable Bubble Challenge.

59 **Reference List**

60 [1] ASTM F2732-16 Standard Practice for Determining the Temperature Ratings for Cold Weather
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63 [2] ASTM D3393-91(2014) Standard Specification for Coated Fabrics—Waterproofness, ASTM
64 International, West Conshohocken, PA, 2014, [https://doi-](https://doi-org.myaccess.library.utoronto.ca/10.1520/D3393-91R14)
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68 [4] Best Buy, "Results for portable power," Best Buy Canada Ltd., 2018. [Online]. Available:
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