Problem 3.3.1 My Surgical Hand Checklist and Rubric

For instructions to use this form, see Checklists and Rubrics for Engineering Essentials in the Engineering Essentials Teacher Guide.

Problem Checklist

Reviewer Name _____ **Date** _____

Problem Contents	Reviewer Comments	Approved
Solution Meets Minimum Criteria and Constraints ☐ Prototype logic gates function. ☐ Prototype responds to manual input. ☐ Prototype is modular. ☐ _____ ☐ _____ ☐ _____ ☐ _____		
Design Process ☐ Each team member thoroughly documents the design process in their PLTW Engineering Notebook and includes at least one entry for each step of the process.		

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Problem Contents	Reviewer Comments	Approved
Deliverables ☐ Documentation of the design process including design brief and decision matrix ☐ Technical guide for the system, including parts list, construction instructions, and code documentation ☐ Test plan, test results, and conclusion ☐ Cost estimate to build the system		
Presentation ☐ Digital or live demonstration of system model		

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Problem Submittal Rubric

The following criteria will be assessed through the project submittals.

D = Domain; O = Objective; KS = Knowledge or Skill

D1 Professional Mindset

	Basic	Proficient	Advanced
O: Demonstrate creativity, flexibility, and adaptability to change.			
KS: Reflect critically on past experiences to inform future progress.	Considers each event to be separate with no connections to what came before or what comes after, unless explicitly reminded about prior learning by others.	Uses previous knowledge, data, theories, or processes to solve challenges (applies previously learned brainstorming techniques or applies systems thinking in a new situation).	Abstracts meaning from an experience and applies it to a new, unrelated situation. Can explain how the previous experience relates to the new situation.

D2 Design Process

	Basic	Proficient	Advanced
O: Apply an iterative design process to creatively address a need or solve a problem.			
KS: Develop a solution and implement a plan to test and evaluate a potential solution to verify that it meets all constraints and complies with all design criteria.	Proposed solutions have limited documentation of iterations. Documentation, if any, displays significant gaps in student knowledge. Some documentation of the prototype or model is presented but not complete. Prototype or model cannot be replicated from documentation. Prototype or model can only be tested to satisfy a limited number of requirements. Significant requirements cannot be tested with the prototype or model. Testing plan does not sufficiently define the procedure, conditions, and methodologies used.	Proposed solutions, including significant iterations, are documented with technical writing and engineering best practices. Multiple iterations of a prototype or model are documented. Prototype or model is generally documented to allow for replication; there are only minor omissions. Prototype or model can be tested to satisfy most requirements and all important requirements. Testing plan sufficiently defines the procedure, conditions, and methodologies used. Tests are documented, and key data are recorded and presented in a clear format.	Proposed solutions, including all iterations, are comprehensively documented with technical writing and engineering best practices. Multiple iterations of the prototype or model are comprehensively documented. Prototype(s) or model(s) are sufficient to validate compliance with design requirements when tested. Prototype(s) or model(s) are documented precisely to allow for replication. If necessary, more than one type of model is created to test all aspects of the design effectively (mathematical, computer 3D solid, physical, graphic, conceptual model).

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	Basic	Proficient	Advanced
	Tests are documented, but gaps exist for important data. Presentation of test results is either lacking or demonstrates gaps in student understanding of how to analyze and interpret data.	Presentation of test results demonstrates a competent understanding of how to analyze and interpret data. Tables, graphs, and/or equations are used to represent the data and communicate test results.	Detailed and comprehensive testing plan defines the procedure, conditions, and methodologies used. If appropriate, multiple iterations of test(s) are performed. All tests are documented, and data are recorded and presented in a clear format. Presentation of test results demonstrates a complex understanding of how to analyze and interpret data. Tables, graphs, and/or equations used to communicate test results are complete, easy to understand, and tailored to the audience.

D5 Computational Thinking

	Basic	Proficient	Advanced
O: Use algorithms to create a solution with or without the use of a computer program.			
KS: Write a set of ordered instructions (with or without a computer) involving multiple discrete steps to accomplish a complex task or achieve a desired result.	With some prompting, writes a partial set of ordered instructions to accomplish a task or achieve a result.	Writes a complete set of ordered instructions to accomplish a task or achieve a result.	Writes a detailed set of ordered instructions to accomplish a task or achieve a result. Iterates on instructions to eliminate inefficiencies in the process.
KS: Implement and analyze algorithms using conditional logic.	With some prompting, creates a basic algorithm that uses simple conditional logic.	Creates an algorithm that uses moderate conditional logic. Analyzes and interprets algorithms that use conditional logic.	Creates an effective algorithm that uses complex conditional logic. Analyzes and interprets algorithms that use conditional logic and identifies ways to improve the conditional approach.
O: Formulate solutions that use automation and programming to solve a problem.			

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	Basic	Proficient	Advanced
KS: Create, interpret, and/or modify a program to manage inputs and outputs of a microcontroller.	With prompting, can interpret some of the code that manages inputs and/or outputs of a microcontroller. With prompting, can create or modify some of the required code that manages inputs and/or outputs of a microcontroller.	Can interpret most of the code that manages inputs and/or outputs of a microcontroller. Can create or modify most of the required code that manages inputs and/or outputs of a microcontroller.	Can interpret all the code that manages inputs and outputs of a microcontroller. Can create or modify all required code that manages inputs and outputs of a microcontroller and ensure the code uses the inputs and outputs efficiently.
Create programs by writing and testing code in a modular, incremental approach.	Inconsistently uses an incremental approach to develop a program. Includes some documentation of the incremental development approach.	Mostly uses an incremental approach to develop a program. Includes sufficient documentation of the incremental development approach.	Consistently uses an incremental approach to develop a program. Includes rich and detailed documentation of the incremental development approach.

D6 Modeling

	Basic	Proficient	Advanced
O: Use spatial visualization to interpret graphical representations of physical objects.			
KS: Build a physical representation of an object, system, or environment. Includes building solid objects, electrical circuits, mechanical devices, and complex systems according to technical drawings.	Produces inefficient physical representation to resemble the design intent.	Produces relatively efficient physical representation in enough detail to demonstrate design intent.	Produces highly efficient physical representation in enough detail to demonstrate design intent.

D9 Project Management

Basic	Proficient	Advanced
O: Apply project management tools when designing and developing a solution to successfully deliver a product using available resources.		

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	Basic	Proficient	Advanced
KS: Define the project deliverables and constraints, such as scope, time, cost, quality, resources, and risk.	Identifies project deliverables and constraints.	Demonstrates an understanding of and can define the project deliverables and constraints.	Thoroughly understands and defines the project deliverables and constraints, along with the impact constraints have on potential solutions.
KS: Develop a project schedule (with critical path identified), allocate tasks among team members, and track progress for successful completion of the project.	Lists tasks with a verb and who is responsible to complete, but workload is not equitably divided.	Develops a project schedule that provides an overview of all tasks necessary to complete the project with start and end dates. Documents formal tasks with an action verb, ways to quantify successful completion, and who is responsible to complete each task. Tasks are equitably allocated among available resources. Clearly documents tasks involved in the critical path sequence. Identifies the impact to the project success if one or more of the critical tasks is not completed on schedule.	Develops a project schedule with all tasks listed including projected start and end dates, and with clearly defined interdependencies between tasks. Collaboratively develops clear and formal tasks and shows how they relate to project deliverables. Tasks are equitably allocated among available resources with primary leader identified while considering team member strengths. Clearly documents the tasks involved in the critical path sequence and identifies the projected start and end dates for the critical path. Identifies the impact to project success if one or more critical tasks are not completed on schedule along with a resolution strategy for how to successfully complete the project on time.

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D12 Communication

	Basic	Proficient	Advanced
O: Communicate effectively with an audience based on audience characteristics.			
KS: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	**Building Presentations** *Audience*: Little evidence that speech/ presentation was designed for the target audience. Little attempt to connect with the audience. Little attempt to explain things at the audience's level. *Content*: Most required content is included. Unnecessary and distracting information is included. *Organization*: Speech is somewhat disorganized and sometimes difficult to follow. Ineffective opening. Ineffective closing. *Purpose*: Purpose of the speech is not completely clear to most listeners. *Mechanics*: Multiple occurrences of incorrect grammar, spelling, or punctuation. Words are used incorrectly.	**Building Presentations** *Audience*: Speech/presentation is designed with the audience in mind. Evidence of attempts to connect with the audience (with audience-specific content/contexts). One or two points could be better explained for this audience. *Content*: All required content is presented. Some extraneous information may be included but does not detract from the purpose. *Organization*: Speech/presentation is effectively organized. Engaging opening creates interest from the audience. Organized body makes sense to audience. Effective closing. *Purpose*: Intended purpose of the speech is clear. *Mechanics*: Correct grammar, spelling and punctuation. Words are used correctly and in the correct context.	**Building Presentations** *Audience*: Speech/presentation is perfectly designed for this audience. Several clear connections to the audience. All key points are understandable from the perspective of the audience. *Content*: Evidence of extensive research. Content includes interesting and impactful information beyond the required content. *Organization*: Can explain strategic choice of organizational structure (problem/ solution, compare and contrast, order of importance, sequential). Opening catches audience's attention. Powerful closing inspires the audience. *Purpose*: Speech/presentation accomplishes the intended purpose. *Mechanics*: Correct grammar, spelling and punctuation. Words are used correctly and in the correct context.
	Technical Writing (all forms) For the criteria to meet this KS at Basic, Proficient, and Advanced levels, see the complete, updated Technical Writing rubric in General Student Resources.		

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	Basic	Proficient	Advanced
KS: Present information, findings, and supporting evidence clearly, concisely, and logically, such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	*Appearance*: Adjusts appearance for the occasion. *Poise*: Appears ill at ease. Displays many distracting behaviors. *Voice*: Difficult to hear and understand words. *Eye Contact*: Minimal eye contact with audience. Reads script. *Gestures*: Minimal body movements, gestures, and facial expressions. *Speed*: Too slow or too fast to hold audience's attention and interest.	*Appearance*: Looks sharp and is dressed appropriately for the occasion. *Poise*: Appears calm. *Voice*: Voice is clear and at an appropriate volume. Good verbal expression with some emotion. *Eye Contact*: Makes eye contact with audience during most of the speech. *Gestures*: Displays some facial expressions and appropriate body language. No distracting behaviors. *Speed*: Good pacing.	*Appearance*: Looks sharp and is dressed appropriately for the occasion. *Poise*: Exhibits confidence. *Voice*: Voice is clear and at an appropriate volume. Verbal expression enhanced with emotion contributes to interesting delivery. *Eye Contact*: Continuous eye contact; looks at each member of the audience. *Gestures*: Facial expressions and body language contribute to meaning. *Speed*: Varies pacing to enhance the message. Uses pauses for dramatic effect.
KS: Make strategic use of digital media (textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence, and to add interest.	Visual aids are only marginally relevant. Visual aids do not add to the presentation, but merely represent what is said. Visual aids are not appropriate for the intended audience or for the presentation environment.	Visual aids are relevant and enhance understanding of the information. Visual aids are neat, attractive, and add interest. Appropriate for the audience. Most of the audience can easily see and interpret the visual aids.	All digital media and visual aids are relevant, well designed, and enhance understanding. Visual aids provide clarity and convey important ideas clearly and concisely (perhaps more effectively than words). Visual aids provide evidence that the presentation environment is being considered and the presentation built and/or revised appropriately.

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