Assessment 1

Instructions
This is your first of four chances to demonstrate your learning of the concepts in class. Unlike common assignment structures at UBC, you will be given the chance later to submit new attempts at previous assessments to improve your mark. This is designed to eliminate a "penalty" for not having learned something yet and to encourage you to submit answers that you are unsure about.

You are assessed on four learning goals per topic in increasing level of difficulty: *knowledge*, *problem solving*, *creativity* and *critique*. *Knowledge* and *problem solving* tasks are going to closely mirror what we have done in class. *Creativity* tasks will ask you to apply class concepts to systems in the real world and use your imagination. *Critique* tasks will ask you to make a short argument that challenges a class concept by using the readings or your own prior knowledge of cognitive systems.

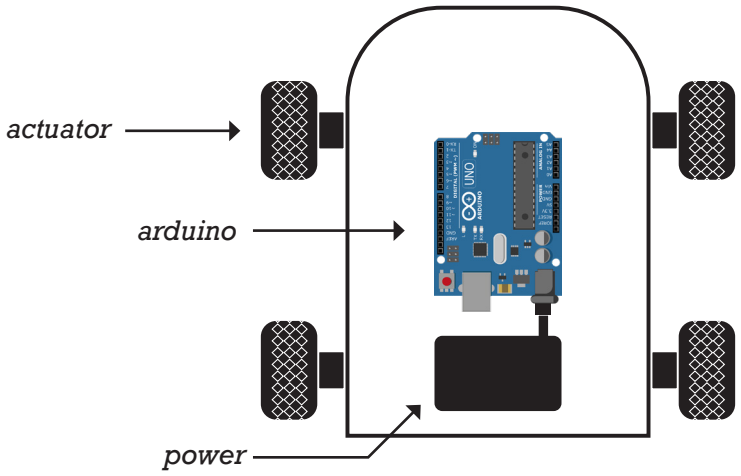
The assessment tasks are difficult and open-ended: you may not feel you are able to complete tasks to perfection by the deadline. Some may take you until the end of term to feel confident about. Since you are allowed to submit new attempts at the tasks in the future, you are encouraged to attempt tasks you are unsure about to get feedback from the instruction staff, and re-attempt tasks you have not completed.

We encourage you to use every resource available to complete the tasks: work in groups to come up with design solutions, get feedback from friends, make notes, look things up on the internet, try things out in the lab, put questions out on the Discord, and ask the instruction staff for help. We only ask that when you sit down to write, your work is your own: put the book away, shut down your browser, sit by yourself and write your own words/draw your own drawings. Every submission should be clearly unique even if it is based on group/prior work: copying the masters is a big part of design, but so is making a design your own.

Submit your work as a PDF or Word document to Canvas by the end of day on Oct 13.
Include your full name and student number at the top. Citations/references not needed unless content is being directly imported and is not subject to fair use/public domain.

Sensation

1. Design a robot that slows down as it approaches a wall and stops once it touches.
Making your own version of the diagram provided where we have already drawn the actuators, draw the placement of the sensors. Then, draw a schematic of how the sensors would be wired (don't worry about the actuators). Last, write a short description of the operation of the robot. You can include code/pseudocodet if you would like, but only a description is required.
learning goals: knowledge, problem solving



2. Using the concepts from class, design or analyze a "real life" example of where a distance sensor would be used.
For example, imagine how either a driverless car might perform distance sensing, or how a vending machine might sense that a product has successfully dropped into the dispenser (or come up with your own example). Don't worry about being "correct" in the sense of reproducing what a car or vending machine actually does, but instead apply your knowledge of distance sensors to analyze how they might work. Draw a diagram that indicates sensor placement and describe the operation; don't worry about including a wiring schematic, code, or pseudocode unless you think it helps your description.
learning goal: creativity

3. Using the concepts from any of the readings and from your own knowledge, compare sensation in a robot to sensation in a human being.
Take a strong stance: choose to argue for or against why robot sensation is a good metaphor for human sensation. Make your argument in absolutely no more than 500 words and no less than 350 words.
learning goal: critique

Actuation

1. Design a claw candy grabber machine.
Draw the motors, simple machines and mechanical linkages that you would need to make the machine work. Importantly, include sensors that will stop the machine from breaking itself if the user tries to push it too far. Describe how the machine works in plain English: don't worry about including wiring, code, or pseudocode unless it's important to your design.
learning goals: knowledge, problem solving

2. Using the concepts from class, design or analyze a "real life" example of a robot that must sense its own position.
For example, a 3D printer or a laser cutter would be a good choice. Don't worry about being "correct" in the sense of reproducing exactly how real 3D printers sense their own position, but instead use your knowledge of encoders and DC motors to analyze how they might work. Use any combination of drawing and description to convey your analysis.
learning goal: creativity

3. Using the concepts from any of the readings and from your own knowledge, compare actuation in a robot to actuation in a human being.
Take a strong stance: choose to argue for or against why robot actuation is a good metaphor for human actuation. Make your argument in absolutely no more than 500 words and no less than 350 words.
learning goal: critique

Control

1. Describe the "P" portion of a PID controller for setting and maintaining a robot's wheel speed by making reference to the set point, measured position, error, and proportional output.
Describe in plain English and/or drawings how the robot wheel would react under the following conditions: first, the wheel can spin freely (as if it's in midair) until it reaches the set speed. Then an external force is applied (as if you put your hand gently on it), slowing down the wheel at first but then allowing it to come up to speed again.
learning goals: knowledge and problem solving

2. Design or analyze a real-life example of a system that must incorporate at least two independent PID controllers.
Describe how PID control would be used in the system, what would constitute the set points, measurements, errors, and outputs. Describe in plain English or drawings the sources of error: what external forces or conditions would impact the system? How would the system respond to those errors? For example, a remote control car with wheels that go at different speeds would be a good choice. Don't worry about being "correct" in the sense of reproducing exactly what a real remote control car does, but instead use your knowledge of the PID controls to analyze how they might work.
learning goal: creativity

3. Using the concepts from any of the readings and from your own knowledge, compare the control of the human body to the control of a robot body.
Take a strong stance: choose to argue for or against robotic control as a good metaphor for cognitive control of the body. Make your argument in absolutely no more than 500 words and no less than 350 words.
learning goal: critique

Synchronization

1. Describe the algorithm for synchronizing firefly flashes (real or electronic) and why it is robust to error.
In plain English, describe both how the algorithm works, and why this would eventually produce the effect of synchronization in the following cases: (1) all of the fireflies start flashing at different times; (2) the fireflies have different internal senses of how long a clock tick is; (3) a non-synchronizable firefly is introduced into the group (i.e., a firefly that doesn't respond to external inputs).
learning goals: knowledge, problem solving

2. Design or analyze a real-life example of a system that synchronizes the timing of multiple outputs.
Describe the process for bringing the components into synchronization and estimate the error of the synchronization. For example, synchronizing the time at which a customer's drink and food are ready at a fast food restaurant would be a good choice. Don't worry about being "correct" in the sense of reproducing exactly what a real fast food restaurant does, but instead use your knowledge of synchronization to analyze the problem, errors, and possible solution.
learning goal: creativity

3. Using the concepts from any of the readings and from your own knowledge, discuss one or more intelligent processes that require synchronization.
Take a strong stance: choose to argue why this process is "just" synchronization or "more than just" synchronization. Make your argument in absolutely no more than 500 words and no less than 350 words.
learning goal: critique