**Mid-term – Part 2 Hands-on Section (Open Book) – 90 minutes time limit**

**Student Name** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Final Score** out of 50: \_\_\_\_\_\_\_\_

**Instructions:**  There are 5 questions. Construct an NXT-based circuit and write the NXC program that demonstrates the following **(10-points each)**

1. Create an angle sensor using a potentiometer. Attach the pot to the NXT’s Port 1. The NXT brick should continuously display the angle of the pot’s shaft. When the shaft is positioned at 12:00; 3:00, 6:00, 9:00 as 0, 90, -90, and 180 degrees respectively. In-between those positions, the brick should display the appropriate angle.
2. Connect an NXT motor to the brick’s Port A. Using the circuit from Q1 above adjust the motor’s speed and direction as follows:

|  |  |  |
| --- | --- | --- |
| Pot Angle | Motor Speed | Motor Direction |
| 12:00 to 3:00 | Increases proportionally from 0 to full-speed | CW |
| 12:00 to 9:00 | Increases proportionally from 0 to full-speed | CCW |

1. A Cadmium Sulfide (CdS) photocell is a 2-wire light dependent resistor. Resistance is inversely proportional to (the square root) of lux value. In other words, the brighter it is, the lower the resistance. Connect a CdS to the NXT’s Port 1. Write a program the displays both the resistance measured across the CdS and brightness level. Calibrate the range such when the CdS is completely covered (dark), the brightness level is 0 and when the CdS is directly exposed to light, the brightness level is 10. For partial exposures, proportionally display the appropriate brightness level
2. Connect an NXT motor to the brick’s Port A. Using the circuit in Q3 above, adjust the motor’s speed as follows:

|  |  |  |
| --- | --- | --- |
| CdS State | Motor Speed | Motor Direction |
| Covered (dark) | Motionless | CW |
| Partially Covered | Increase speed proportionally | CW |
| Uncovered (bright) | Full speed | CW |

1. Recall that the NXT’s motor ports (Port A, B, and C) can serve as an adjustable voltage source. Connect a reed relay to Port A. Write an NXC program that closes/opens the reed relay’s switch when the user presses the left and right arrows respectively. Connect a toy DC motor to a 9V battery and pass it thru the relay. Thus, when the switch is closed (left arrow), activate the motor. When the switch is open (right arrow), de-activate the motor