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Name_____ Student ID._____

King Mongkut's University of Technology Thonburi
Final Examination of First Semester, Academic Year 2016

COURSE CPE 111 Computer Engineering Exploration
Automation Engineering 1st year
Thursday, December 1, 2016 13.00 – 16.00 h.

Instructions

1. This examination contains 4 parts, 12 pages (including this cover page), total 100 points.
2. Write your answers in the spaces provided in the examination paper.
3. This exam is open exam. Students are allowed to bring documents, dictionary and calculator that conforms to the university rules.

Students must raise their hand to inform to the proctor upon their completion of the examination, to ask for permission to leave the examination room.
Students must not take the examination and the answers out of the examination room.

Students will be punished if they violate any examination rules. The highest punishment is dismissal.

Examination compiled by
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This examination has been approved by the Department of computer engineering.

Assoc. Prof. Peerapon Siripongwutikorn, Ph.D.
Program Chairperson

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Part 1: POP-168 Microcontroller (25 points)

1.1 From the following code, the developer tries to build an embedded device. The device is designed to detect the object in range by IR distance sensor. If the device is too closed, then LED1 is turned on. The device also generates a sound in case of the bumper PB2 is pushed while hitting the object.

```
 1  int nearObject() {
 2      int value = analogRead(6);
 3      if(value > 300) { return 1; }
 4      else { return 0; }
 5  }
 6
 7  void setup()
 8  {
 9      pinMode(6, OUTPUT);
10      pinMode(5, OUTPUT);
11      pinMode(4, INPUT);
12  }
13
14  void loop()
15  {
16      if(nearObject() == 1) {
17          digitalWrite(5, LOW); // Turn light on
18      }
19      else {
20          digitalWrite(5, HIGH); // Turn light off
21      }
22      if(digitalRead(4) == 1) {
23          for(int i=0; i<500; i++) {
24              delayMicroseconds(1911);
25              digitalWrite(6, LOW);
26              delayMicroseconds(1911);
27              digitalWrite(6, HIGH);
28          }
29      }
30  }
```

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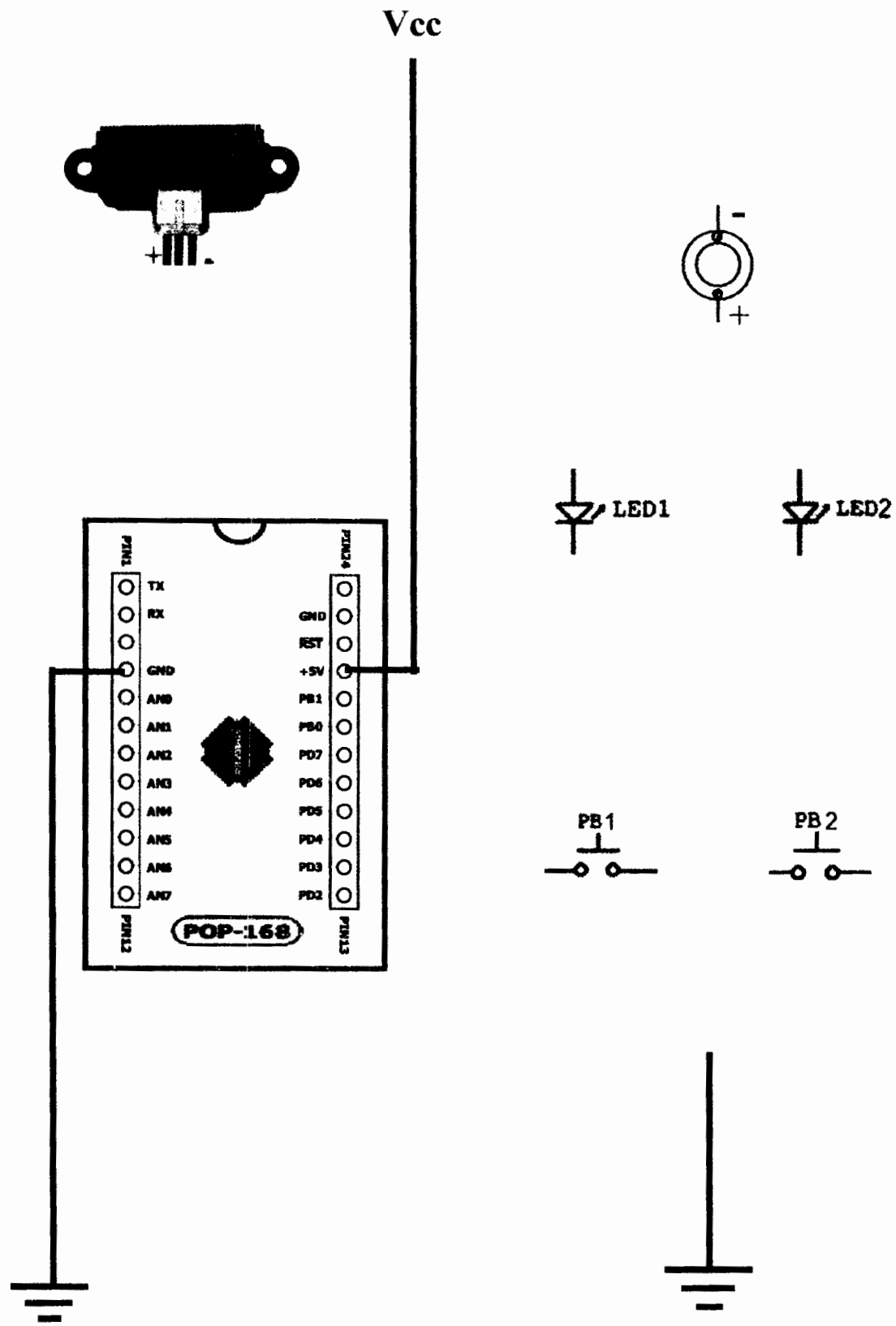
Draw all necessary lines and components to connect the circuit below as the developer want. (5 points)



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1.2 Please explain what would happen if this program is compiled and uploaded for executing on this POP-168 board (after reset is pressed) when PB2 is pushed. (5 points)

```
 1  void  setup() {
 2      pinMode(4,INPUT);
 3      pinMode(6,OUTPUT);
 4  }
 5  void loop() {
 6      int IN = digitalRead(4);
 7      if (IN == 0) X1();
 8      if (IN == 1) X2();
 9  }
10  void X1() {
11      digitalWrite(6, HIGH); delayMicroseconds(1911);
12      digitalWrite(6, LOW); delayMicroseconds(1911);
13  }
14  void X2() {
15      digitalWrite(6, HIGH); delayMicroseconds(955);
16      digitalWrite(6, LOW); delayMicroseconds(955);
17  }
```

1.3 In order to program a POP-168 mobile robot to pass the blind racing (แข่งรถแบบมองไม่เห็น), please explain in some details about how to solve this problem. (5 points)

1.4 In order to program a POP-168 mobile robot to pass the hit TAs (ใส่ชนผู้ช่วยสอน), please explain in some details about how to solve this problem. (5 points)

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1.5 In order to program a POP-168 mobile robot to pass the untouchable blue wall (กำแพงฟ้าใครอย่าแตะ), please explain in some details about how to solve this problem. (5 points)

1.6 Please write a program for running on this POP-168 board and making above circuits to happen (after reset is pressed) as follows... (5 Points)

LED1 ON Wait 2 seconds LED1 OFF Have sound for 4 seconds Wait one and a half second Repeat all

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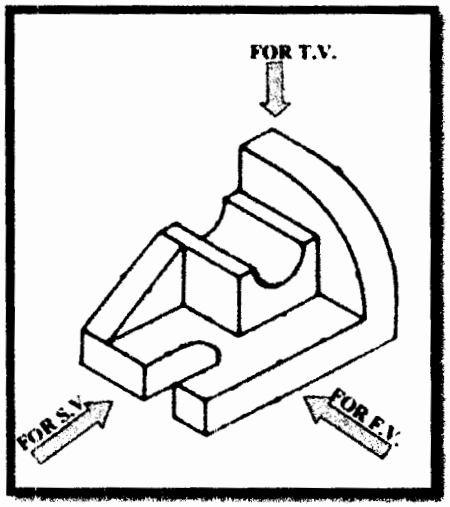
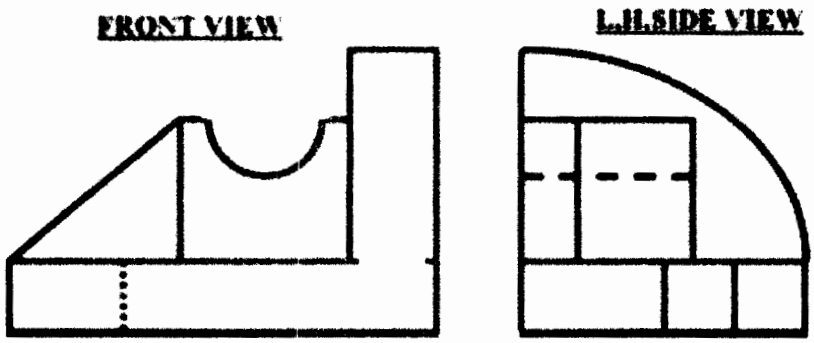
Part 2: Engineering Drawing (25 points)
Answer the following questions:

2.1 Sketch the lost drawing side. (10 points)





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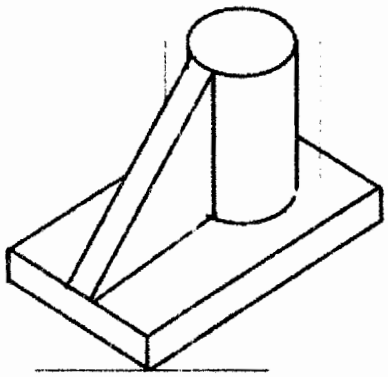
2.2 Sketch the top and left side of orthographic drawing. (15 points)



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2.3 SolidWorks: In order to get this rendered donut, please list all commands we have to use in SolidWorks. (Bonus 5 points)

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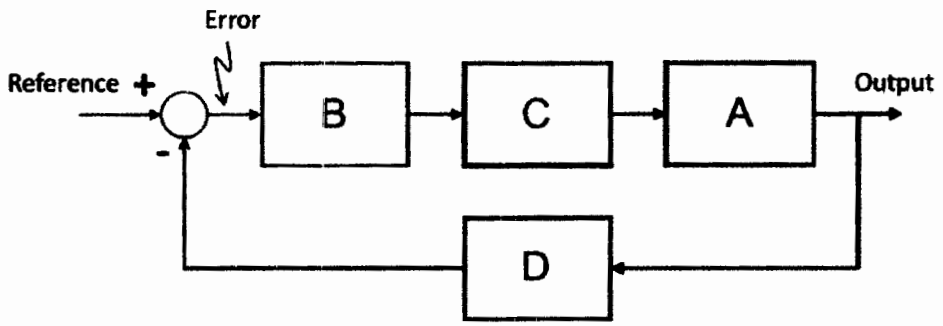
Part 3: Engineering Fields (25 points)

3.1 How does selecting material affect product made by engineers? (2 points)

3.2 What is the purpose of civil engineering? (2 points)

3.3 Fill in the components of control system in the graphic below, and explain what each component does. (3 points)

CONTROL SYSTEM



a. [Example] (Plant) the object that is going to be controlled.

b. (_____) _____

c. (_____) _____

d. (_____) _____

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3.4 Why can an airplane fly? (2 points)

3.5 Give a <u>short</u> explanation of the following terms in the aspect of engineering. (อธิบายคำต่อไปนี้ในมุมมองทางวิศวกรรมโดยสังเขป) (16 points)

a. Material Properties

b. Permanent deformation

c. Structural engineering

d. Water management

e. "Digital" and "Analog" system

f. Mechatronics

g. Equation of motions

h. Aerodynamics

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Part 4: Engineering Design Process (25 Points)

4.1 Please write a design process flowchart that explains workflow steps of your course project by using the Engineering Design Process concept. (10 points)

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4.2 Please describe about your course project as follow (15 points)

Project Topic

Project Objectives

Project Outcomes

Project System Diagram