

**CG1112 Engineering Principle and Practice II**  
**Semester 2 2018/2019**

**Tutorial 1 Suggested Solutions**  
**Part 2 – Understanding Micro-controller**

**Objectives:**

- Get familiarized with the Atmel AT328p Microcontroller
- Learn how to extract useful information from the datasheet

**Introduction**

The datasheet is a very integral and useful document that gives us a lot of information with regards to the device we are using. Without the datasheet, we will effectively be trying to connect and use a device “blindly”.

**Task 1:**

Download the complete Atmega328p datasheet from IVLE. **Memorize all 442 pages of it.** You will be asked questions from any of the pages during your mid-term.

☺ Ok. Just kidding.

**Actual Task 1:**

Download the datasheet and answer the following questions by just **referring to the first 2 pages:**

1. How many bit microcontroller is this device? What can you deduce from your answer?

**Answer:**

**8 – bit Microcontroller.**

**It means that it can deal with 8-bit data at a time. Indirectly implies that all its internal working registers are also generally 8-bit.**

2. What is the fastest speed at which this device can operate?  
Can it be clocked even faster than that?

Answer:

20MHz

Possible, because manufacturers always give you the lower bound to be safe. Many devices can actually run faster than that, but it is not recommended as it is NOT guaranteed by the manufacturer.

### **Task 2: Understanding the Block Diagram**

Go to **Section 4 of the datasheet** and answer the following questions:

3. How many I/O ports are there and what are their bus widths?

Answer:

3 I/O ports

PortB: 8-bits [7:0]

PortC: 7-bits [6:0]

PortD: 8-bits [7:0]

4. Note down the mapping of PortB pins to the actual Microcontroller Pins.

Answer:

PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
10	9	19	18	17	16	15	14

### **Task 3: Understanding Multiplexing**

Due to the limited number of pins, it is common for pins to have multiple functionalities. Refer to Section 6 on I/O Multiplexing.

5. What are PB7 and PB6 already used for in the Uno board? (Refer to the Arduino Uno Schematic)

Answer:

They are already connected to the external clock. So, they are no longer available for use as General Purpose I/O.