*Surname:*

*Other Names:*

*Student ID number:*

# ENGR101 Engineering Technology

# Test One – 20th March 2014

*Instructions:*

Total time allowed 35 minutes

There are 25 marks in total

Answer all questions

Write your answers on this sheet and take care to hand in all sheets. Additional paper is available should you need it.

**Show your working.**

This test contributes 2% of your final grade

Non-electronic translation dictionaries are permitted

Calculators are **not** permitted

## Marking

| | |
|---|---|
| Part 1: Ethics and Real World Engineering | /8 |
| Part 2: Binary Arithmetic | /8 |
| Part 3: Command Line | /4 |
| Part 4: Computer Architecture | /5 |
| TOTAL: | /25 |

## *Part 1: Ethics and Real World Engineering*

Q1. Briefly discuss one reason why a professional body such as Institution of Professional Engineers New Zealand (IPENZ) might have an ethical code for it's members, rather than just relying on the country's laws. [4 marks]

Your answer should have been along the lines of the following things:

* an ethical code of conduct covers things such as keeping an adequate level of lifelong training in the discipline, which isn't covered by any specific existing law.
* an ethical code can state requirements that are sensible for professionals in that field, but that might not sensibly apply to other professionals. Hence the ethical code can be more easily made to apply to those that it needs to, rather than a blanket statement over all citizens and residents.
* the ethical code can be maintained by the professional body responsible for running that profession, and who are well-placed to judge what is appropriate for that profession. Laws are made by parliament, who can oversee the performance of the professional body but can delegate the handling of ethical issues.

Anything along these lines (or something that sounds equally defendable) would have received full marks here.

Q2. Briefly discuss the ethical implications of the following scenario, from the point of view of a professional engineer. [4 marks]

You are working for a company that is developing a new software system for a group of government ministries. The software will handle the tracking and archiving of any official emails that are sent out by government ministries to citizens or organisations. Some of these emails are confidential in nature. As well as this, the software will allow people to search for any emails sent to them by the ministries, if they can provide a unique identifying user name and password that was previously set up by the receiver through the software's web-based central interface.

The contract that your company has with the government states that there will be a financial penalty to the company if the software is delivered late, and this late penalty is significantly greater than any penalties that would be applied if there are problems in the software that do not "directly stop tasks from being performed".

You are aware that there is a problem in the software's web-based central interface. This problem may cause a possible security hole, that would make it possible for users to search for other users' emails and gain access to these emails. However, the company has determined that this software problem will not "directly stop tasks from being performed", and therefor it makes financial sense to release the software on time and fix the problem in the next release set for one month later.

Your answer should have been along the lines of the following things:

- an engineer's first responsibility is to society, so if there are serious implications regarding possible privacy breaches because of a known fault or feature, then an engineer should argue this to their company first, and if not resolved satisfactorily, then alert the customer and other stakeholders.
- an engineer should not be solely guided purely by what makes financial sense for their immediate employer.
- because the engineer is dealing with a system that contains private information for citizens or organisations, that those citizens and organisations are stakeholders in the outcome of the system, and need to be considered.
- Some people may make the additional argument about the specifics of how such an exploit should be released if the system has gone live, such as giving the company 90 days to fix it before announcing it to the public, as compared to a 0-day exploit.

## *Part 2: Binary Numbers*

Q3. Although we are used to counting in decimal and performing manipulations using base-10 numbers, briefly describe one real world system that uses binary numbers and why base-2 is chosen for use in this system rather than base-10. [2 marks]

Something along lines of: base 2 because computers only recognize 2 states - on and off (i.e. voltage applied/not applied etc.), which are represented as 0 and 1.

Q4. Convert $57_{10}$ and $4_{10}$ to 8-bit binary numbers. Be sure to show your working. [2 marks]

| Number | /2 | remainder |
|---|---|---|
| 57 | 28 | 1 |
| 28 | 14 | 0 |
| 14 | 7 | 0 |
| 7 | 3 | 1 |
| 3 | 1 | 1 |
| 1 | 0 | 1 |

| Number | /2 | remainder |
|---|---|---|
| 4 | 2 | 0 |
| 2 | 1 | 0 |
| 1 | 0 | 1 |

Read bottom to top and insert extra 0's infront to make up to 8 bits
57 (dec) = 0011 1001 (binary)  4 (dec) = 0000 0100 (binary)

Q5. Using 8-bit one's complement arithmetic determine $57_{10}$ - $4_{10}$ . Be sure to show your working [4 marks]

57 (dec) = 0011 1001 (binary)  - 4 (dec) = 1111 1011 (binary, 1s complement)

```
  0011 1001  +
  1111 1011
  0011 0100  ANSWER PART 1
 11111   11   CARRY
```

Then as we're working in 1's complement you need to add the extra 1 back on to ANSWER PART 1 to get the final answer = 0011 0101 (binary) = 53 (dec)

## *Part 3: Command Line*

Q6. I have a file called "SchoolGalaHelpers.txt" on my computer. I want to create a copy of this file that will be called "SchoolGalaHelpers_v2.txt" in the same directory as the original file, and I've decided to use the command line to achieve this. I use the following command at the command prompt.

**mv SchoolGalaHelpers.txt SchoolGalaHelpers_v2.txt**

Even though I'm in the right directory, my command does not achieve my goal. Discuss why my command has not achieved my goal, and describe what I would need to do to get back to the state I wanted to be in now that I've accidentally run this incorrect command. [3 marks]

'mv' command does not leave a copy behind, but merely moves the file.
You need to use the 'cp' command to create a copy of a file.
(Yes, you could go 'cat SchoolGalaHelpers_v2.txt > SchoolGalaHelpers.txt' too, or use the 'more' command - that is also correct, although is a bit over the top :) )

Remember that you need to reverse the names, so it needs to be 'cp SchoolGalaHelpers_v2.txt SchoolGalaHelpers.txt'. If the filenames are in the original order, it will complain as the old file name no longer exists.

Q7. Given that the command line tools are generally harder to learn than the equivalent desktop graphical user interface tools, briefly describe one reason why it might still be useful to learn about and use the command line tools. [1 marks]

There are a couple of reasons - command line interfaces support chaining actions together to be able to construct complex commands from simple commands, including passing output from one as the input of another. This can be quicker to achieve with command line interfaces.

## *Part 4: Computer Architecture*

Q8. Pressing a key on the keyboard or moving the mouse triggers alerting signals which are then sent to the processor through the operating system. These signals, from an external device or from a component such as a hard disk controller within the computer itself, can be handled either through interrupts or polling. Different architectures handle such alerting signals differently, resulting in differing performance with respect to metrics such as speed, ease of programming and production costs. For modern desktop computers argue why one architecture outperforms the other. [5 marks]

Modern desktops host many devices (printers, hard disk, usb, pci, graphics...) thus posing different engineering requirements to calculators and hand phones.

1. Polling
   - Ease of programming, no need for sophisticated programming of interrupt handling and prioritisation.
   - Predictable delay (slow)
   - lower cost than interrupt

2. Interrupt driven
   - fast
   - complicated programming (use of locks, priority masking)
   - more costly (dedicated interrupt line handlers)