

THE UNIVERSITY OF MELBOURNE
SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

MID-SEMESTER TEST SAMPLE
COMP10002 FOUNDATIONS OF ALGORITHMS

Total marks for this Exam: 10

Reading Time: 5 minutes

Writing Time: 40 minutes

This exam has 4 pages.

Identical Examination Papers: None

Common Content Papers: None

Authorised Materials:

Writing materials, e.g., pens, pencils, are allowed.

Books, calculators, and dictionaries are not allowed.

Instructions to Students:

- Attempt all questions.
- Clearly write your answers. Any unreadable answer will be considered wrong.

1. [3 marks] Consider the following program execution:

```
mac:./starTriangle
Enter an integer: 5
*
**
***
****
*****
mac:
```

This program reads an integer n, and then prints a triangle with n rows of '*' characters. Complete the following program to implement the above process. You can declare more variables if necessary.

```
/* Program to print a '*' triangle */
#include <stdio.h>
#include <stdlib.h>
```

```
int
main(int argc, char **argv) {
    int n;
```


```
        return 0;
    }
```

2. **[4 marks]** Write a function `int count_factors(int n)` that calculates and returns the number of factors, including 1 and itself, of the argument variable `n`.

For example, the call `count_factors(15)` should return 4 (factors of 15 being 1, 3, 5, and 15). You may assume $n > 0$.

[illegible]

3. [3 marks] The following functions describe the computation behavior of a number of algorithms:

- (a) $f_1(n) = 3n - 2$
- (b) $f_2(n) = n - 4\log n + 5$
- (c) $f_3(n) = f_1(n) + f_2(n)$
- (d) $f_4(n) = f_1(n) - f_2(n)$
- (e) $f_5(n) = f_1(n) \times f_2(n)$
- (f) $f_6(n) = f_1(n) / f_2(n)$

Using the “big-Oh” notation, what is the *best description* of the asymptotic growth rate of each of the functions $f_1()$ to $f_6()$?

(a)
(b)
(c)
(d)
(e)
(f)

End of sample exam