School of Computing and Information Systems

COMP10002 Foundations of Algorithms

Sample Mid-Semester Test #2

Student Number:

Time Allowed: Thirty minutes.

Authorised Materials: None.

Instructions to Students: This paper counts for 10% of your final grade. All questions should be answered in the spaces provided on the test paper.

And yes, there will be more lines in each set of boxes in the real test.

Question 1 (7 marks).

Consider the following interactions:

```
mac: ./pattern
Enter a value between 1 and 20: 50
Must be between 1 and 20
mac: ./pattern
Enter a value between 1 and 20: five
Invalid input
mac: ./pattern
Enter a value between 1 and 20: 7
            *
          * * *
        * * * * *
      * * * * * * *
    * * * * * * * * *
  * * * * * * * * * * *
* * * * * * * * * * * * *
mac:
```

Write the program `pattern` that reads an integer, checks that it is between the specified bounds, and then prints a triangle pattern containing that many rows.

```
/* Program to print a triangular pattern */
#include <stdio.h>
#include <stdlib.h>

#define MAX 20

int
main(int argc, char *argv[]) {
```


(Yes, it takes more lines than this.)

```
    return 0;
}
```

Question 2 (3 marks).

Consider the following functions:

$$f_1(n) = 3n^2 + 100\sqrt{n}$$

$$f_2(n) = 2n^2 \log n$$

$$f_3(n) = 2n^2 + \log n$$

Using the *best* representative function in each case, categorize the asymptotic growth rate of the following combinations using the "big-Oh" notation:

(a) $f_1(n) + f_2(n)$

(b) $f_1(n) - f_3(n)$

(c) $f_1(n) \times \sqrt{n} + f_2(n) \times \log n$

(d) $f_2(n)/f_3(n)$

(e) Now add the words "fastest" and "slowest" to two of boxes (a)–(d) to indicate, respectively, the asymptotic growth rate that is the highest (that is, least desirable for an algorithm to possess), and the asymptotic growth rate that is the smallest (that is, most desirable for an algorithm to possess).