School of Computing and Information Systems

COMP10002 Foundations of Algorithms

Sample Solution to Sample Mid-Semester Test #2

Question 1 (7 marks).
It's all about getting the loop control right, and being able to "visualize" the triangle into the sequence of for loops. And knowing the recipe for reading an input value and testing that something was read.

```
/* Program to print the required triangle */

#define MAX 20

int
main(int argc, char **argv) {

    int n, i, j;
    /* get the input value */
    printf("Enter a value between 1 and %d: ", MAX);
    if (scanf("%d", &n)!=1) {
        printf("Invalid input\n");
        /* nothing there to be read */
        exit(EXIT_FAILURE);
    }
    /* test for validity */
    if (n<1 || n>MAX) {
        printf("Must be between 1 and %d\n", MAX);
        exit(EXIT_FAILURE);
    }
    /* draw triangle, row by row */
    for (i=1; i<=n; i++) {
        /* leading blanks */
        for (j=i+1; j<=n; j++) {
            printf("  ");
        }
        /* then the *s */
        for (j=1; j<2*i-1; j++) {
            printf("* ");
        }
        /* last star, plus a newline */
        printf("*\n");
    }
    return 0;
}
```

Question 2 (3 marks).

(a) $f_1(n) + f_2(n) = 3n^2 + 100\sqrt{n} + 2n^2 \log n \in O(n^2 \log n)$.

(b) $f_1(n) - f_3(n) = 3n^2 + 100\sqrt{n} - (2n^2 + \log n) \in O(n^2)$.

(c) $f_1(n) \times \sqrt{n} + f_2(n) \times \log n \in O(n^{2.5})$ and is the fastest growing function.

(d) $f_2(n)/f_3(n) = \frac{2n^2 \log n}{2n^2 + \log n} \in O(\log n)$, and is the slowest growing function.