

Lab Exercises Week 2

1 Templates

1.1 Function Templates

Create a function template with signature `T mid(T val1, T val2, T val3)` that takes three values of type `T` and returns as a result the value `midVal` which is one the values `val1`, or `val2` or `val3` that satisfies the condition:
`minimum(val1,val2,val3) <= midVal < max(val1,val2,val3)`.

1.2 Class Templates

Create a class template called `Rectangle` that has two private variables `width`, `height` of type `T` (a parameter), a constructor, getters `GetWidth` and `GetHeight` that return respective values of type `T`, and two overloaded comparasion operators `<`, `>`. Two rectangles are compared based on their surface area, that is rectangle with width 5 and height 4 is grater than the rectangle with with 2 and height 8. The `main()` program must create three objects of type `Rectangle<double>` and return the middle sized rectangle using the function `mid` from the previous exercise.

2 Big-O Complexity

2.1

Determine the complexity of the following implementations of the algorithms for adding, multiplying and transposing $n \times n$ matrices:

```
for (i = 0; i < n; i++)
    for (j = 0; j < n; j++)
        a[i][j] = b[i][j] + c[i][j];

for (i = 0; i < n; i++)
    for (j = 0; j < n; j++)
        for (k = a[i][j] = 0; k < n; k++)
```

```
    a[i][j] += b[i][k] * c[k][j];

for (i = 0; i < n; i++)
    for (j = i+1; j < n; j++) {
        tmp = a[i][j];
        a[i][j] = a[j][i];
        a[j][i] = tmp;
    }
```

2.2

Determine the computational complexity of the following two loops:

```
for (cnt1 = 0, i = 1; i <= n ; i++)
    for(j = 1; j <= n; j++)
        cnt1++;

for (cnt3 = 0, i = 1; i <= n; i *= 2)
    for (j = 1; j <= n; j++)
        cnt3++;
```