# COMP1927 15s2 Final Exam

[Instructions] [C language] [Algorithms]
[Q1] [Q2] [Q3] [Q4] [Q5] [Q6] **[Q7]** [Q8] [Q9]

## Question 7 (6 marks)

Consider the bottom-up version of mergesort:

```
#define min(A,B) ((A < B) ? A : B)

void mergesort(char a[], int lo, int hi)
{
   int i, m; // m = length of runs
   int end; // end of 2nd run
   for (m = 1; m <= hi-lo; m = 2*m) {
      for (i = lo; i <= hi-m; i += 2*m) {
         end = min(i+2*m-1, hi);
         merge(a, i, i+m-1, end);
      }
      // show state of array at this point
   }
}
void merge(char a[], int lo, int mid, int hi)
{
   int  i, j, k, n = hi-lo+1;
   char *tmp = malloc(n*sizeof(char));
   i = lo; j = mid+1; k = 0;
   // scan both segments, copying to tmp
   while (i <= mid && j <= hi) {
     if (a[i] < a[j])
        tmp[k++] = a[i++];
     else
        tmp[k++] = a[j++];
   }
   // copy items from unfinished segment
   while (i <= mid) tmp[k++] = a[i++];
   while (j <= hi) tmp[k++] = a[j++];
   //copy tmp back to main array
   for (i = lo, k = 0; i <= hi; i++, k++)
      a[i] = tmp[k];
   free(tmp);
}
```

Now consider sorting the following array:

| | [0] | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | s | o | r | t | i | n | g | i | s | a | w | e | s | o | m | e |

via the following call to the `mergesort()` function:

```
mergesort(A, 0, 15);
```

A. Show the state of the array after each execution of the inner `for` loop (see comment in program). (4 marks)

   Simply writing a sequence of characters is adequate to show the state of the array, e.g.

   ```
   s o r t i n g i s a w e s o m e
   ```

B. What is the purpose of the statement `end = min(i+2*m-1, hi)`? (2 marks)

Type the answer to this question into the file called `q7.txt` and submit it using the command:

```
submit q7
```