SCC 120 Introduction to Data Structures
Workshop Two : Binary, Arrays, and Strings

Q1.

i. Convert **-45** to an 8-bit binary using 2's complement representation.

11010011

ii. What is the decimal equivalent of the two's complement 8-bit binary 11011011?

a. This is a negative number because the leading bit is 1.
b. We first find the binary representation of the positive value by taking its 2'complement. This gives us 00100101
c. The decimal equivalent of binary 00100101 is 37
d. So the negative value will be -37

Q2.

`recordArray` is a linear array of some type. Assume each element of `recordArray` occupies **6** bytes and each byte in the memory has its own address. Like arrays in C, the indices of `recordArray` start from 0.

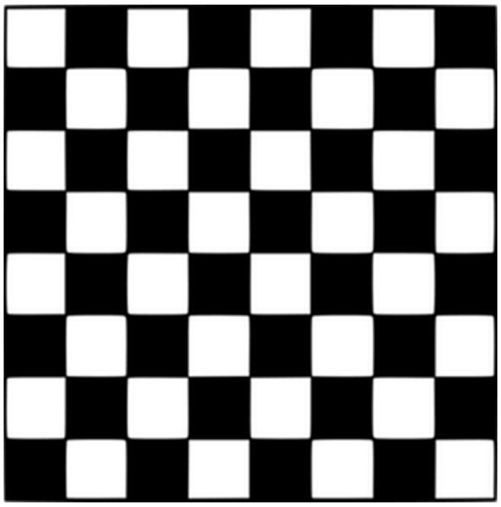
Let's said the memory address of the first element of this array, i.e. `recordArray[0]`, is **n**. What is the memory address of `recordArray[i]`?

n + (6*i)

Q3. Below is a picture of a chess board and a declaration of an array `chessboard` to represent it:

```
# define WHITE 0
# define BLACK 1
# define SIDE_SIZE 8

static int chessboard [SIDE_SIZE][SIDE_SIZE];
```



Write an algorithm that assigns each square in `chessboard` the correct colour. Assume that `chessboard[0][0]` is the top left-hand square, and that the first index represents rows and the second index represents columns. You can give your answer in pseudo-code. You don't have to write syntactically correct C. However, if you do want to use C, the int '`%`' modulus operator will give you the remainder as follows: `number % divisor = remainder`

```
for (row = 0, row < SIDE_SIZE, row++)
      for (column = 0, column < SIDE_SIZE, column++)
      {
            if (row % 2 == 0)
                  if(column % 2 == 0)
                        chessboard[row][column] = WHITE;
                  else
                        chessboard[row][column] = BLACK;
            else
                  if(column % 2 == 0)
                        chessboard[row][column] = BLACK;
                  else
                        chessboard[row][column] = WHITE;
      }
```

or

```
for (row = 0, row < SIDE_SIZE, row++)
      for (column = 0, column < SIDE_SIZE, column++)
            chessboard[row][column] =
                  !( row % 2 == column % 2)
```

`(i.e. if row and column are both odd or both even. Remember that a Boolean expression returns 0 if false and 1 if true, and that in our program, white = 0 and black = 1)`

Q4. In C, the function `strcmp` takes two strings as parameters. `strcmp(s1, s2)` returns a negative integer if `s1` is less than `s2`, 0 if they are the same and a positive

integer if `s1` is greater than `s2`. For the variables x and y in the following say whether their values are –ve, +ve or 0.

```
int x = strcmp("aardvark", "ant");
int y = strcmp("bob", "Bob");
```

Hint: the upper-case characters A .. Z have ASCII values in the range 65 .. 90 (Decimal) and the lower-case characters a .. z have ASCII values in the range 97 .. 122.

```
x is –ve
y is +ve
```

Q5. In C, what does the special character '\0' signify?

a. The end of a string.
b. An emoticon popular in parts of Galgate.
c. Uh-oh!
d. A null pointer.