

CLASSICAL AND QUANTUM COMPUTING
EXERCISE IV

Write a C++ program to convert between unsigned integer number representations. For the internal representation we can use an array of `int` to store the coefficients, where the the first entry is the base and the last entry is -1 . Thus, to represent the number 43 decimal in binary we would use the array

$(2, 1, 1, 0, 1, 0, 1, -1)$.

Write C++ functions of the form

```
int most_significant(int x,int base);  
void tobase(int x,int base,int *&rep);  
void convert_base(int *inrep,int base,int *&outrep);
```

The function `most_significant` calculates the size of the array of coefficients for the representation. For the above example (binary representation of 43) the value returned is 5 (the coefficient of 2^5 is the last entry of the array). The function `tobase` takes an integer and stores the representation for `x` in `rep`, `tobase` should allocate the memory for `rep`. Explain the reason for the data type of the third parameter of `tobase`. The function `convert_base` is equivalent to `tobase`, except it takes an arbitrary representation for the integer to convert.

Use the program to convert 157 decimal to binary, and then from binary to ternary (base 3) representation.