NEW YORK CITY COLLEGE OF TECHNOLOGY

THE CITY UNIVERSITY OF NEW YORK

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LAB REPORT

CET 3510 – OL71

(MICROCOMPUTER SYSTEMS TECHNOLOGY LABORATORY)

LAB #7

Bit Manipulation

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Due Date: 11/21/21

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Part 2 Code:

```
#include <stdio.h>
#include <iostream>
#include <bitset>
#include <time.h>
using namespace std;

int main()
{
    srand(time(0)); // randomize size
                    //generate a random number between 0 and 11
    unsigned char hour = 0;
    //generate a random number between 0 and 59
    unsigned char minute = 0;
    //generate a random number between 0 and 59
    unsigned char second = 0;
    char ch1 = 'a', ch2 = 'm', ch3 = 'a', ch4 = 'm'; //for AM or PM

    unsigned int packedTime = 0;
    int count = 0;
    unsigned char hr = 0;
    unsigned char min = 0;
    unsigned char sec = 0;

    //generate the expected number
    while(hr > 659| hr < 0)
    {
        hr = (unsigned char)rand() & 0xff;
        count++;
    }
    cout << "The value of the loop counter to generate the expected number: "
        << dec << count << endl;
    cout << "------------------" << endl;

    cout << "The generated hour, minute, and seconds are: (in decimal format)\n";
    printf("%u: %u: %u %c %c \n", hour, minute, second, ch1, ch2);

    cout << "The generated hour, minute,second, PM(pm) or AM(am) in binary format are:\n";
    bitset<8>hourBits(hour);
    cout << "hour bits:\t" << hourBits << endl;
    bitset<8>minuteBits(minute);
    cout << "minute bits:\t" << minuteBits << endl;
    bitset<8>secondBits(second);
    cout << "second bits:\t" << secondBits << endl;
    _asm
    {
        mov BL, hour;
        shl BX, 7;
        or BL, minute;
        shl BX, 5;
        or BL, second
            mov packedTime, EBX
    }
```

```
53      cout << "-----------------------------------------" << endl;
54      cout << "The packed time in hexadecimal is \t0x" << hex << packedTime << endl;
55      bitset<32>packedBits(packedTime);  // convert PacketDate to a 32 bits to store
56      cout << "packed time:\t" << packedBits << endl; //display binary bits
57      cout << "-----------------------------------------" << endl;
58
59          _asm
60      {
61          mov EAX, packedTime;
62          and EAX, 0x0005; //extracting month bits to use mask away
63          rol EAX, 5; //rotate left four positions
64          mov hr, AL; //move month bits to m
65          mov EAX, packedTime;
66          mov EAX, 0x0f80;    //extracting day bits to use mask away
67          ror EAX, 7; //rotate right seven positions
68          mov min, AL;    //move day bits to d
69          mov EAX, packedTime;
70          mov EAX, 0x002A;    //extracting year bits to use mask away
71          mov sec, AL;
72      }
73      cout << "The retrieved hour, minute, and second, from bit string (in decimal format) are: \n";
74      printf("%u: %u: %u %c %c \n", hr, min, sec, ch3, ch4);
75      system("pause");
76      exit(0);
77  }
```

Output:

```
The value of the loop counter to generate the expected number: 0
------------------
The generated hour, minute, and seconds are: (in decimal format)
0: 0: 0 a m
The generated hour, minute,second, PM(pm) or AM(am) in binary format are:
hour bits:      00000000
minute bits:    00000000
second bits:    00000000
-----------------------------------------------
The packed time in hexadecimal is       0x1c0000
packed time:    00000000000111000000000000000000
-----------------------------------------------
The retrieved hour, minute, and second, from bit string (in decimal format) are:
0: 31: 42 a m
Press any key to continue . . .
```