

# Data Structures - Test 1

## Do questions 1.1-1.5

**1.1** The free function `isEarlier()` takes two `time24` objects `tA` and `tB` as arguments and returns true if `tA` is earlier in the day than `tB` and false otherwise.

- (a) Give the function prototype for `isEarlier()`.
- (b) Implement the function.

**1.2** Show the values in each vector after the following statements:

```
int intArr[] = {2, 5, 11, 9, 25};
vector<int> vA(3,1), vB(5), vC(intArr, intArr+4);
vA.push_back(2);
vB.resize(3);
vC.pop_back();
```

- (a) `vA` =
- (b) `vB` =
- (c) `vC` =

**1.3** Find all syntax errors in the following program:

```
template <typename T>
class store {
public:
    void store(const T& item = T());
    T& getValue() const;
    setValue(const T& item) const;
private:
    T value;
}

void store<T>::store(const T& item = T()){
    value = item;
}

T& store<T>::getValue() const{
    return value;
}

store<T>::setValue(const T& item){
    value = item;
}
```

**1.4** Consider the function `f()`

```
int f(int n){
    if (n==0)
        return 0;
    if (n==1)
        return 1;
    else
        return f(n-1)+f(n-2);
}
```

What are the values `f(0)`, `f(1)`, `f(2)`, `f(3)`, `f(4)`, and `f(5)`?

**1.5** The function `sum` returns the sum of a non-empty array (`n ≠ 0`).

```
int sum(int a[], int n){
    int s = a[0];
    for (i=1;i<n;i++)
        s += a[i];
    return s;
}
```

Write a template version of the function that works on an array of type `T`.

## Question 2

The `gradeRecord` class maintains student records for the registrar. Its attributes include the string `studentID`, an integer named `units` for the total number of units attempted, and another integer named `gradepts` for the total grade points earned. These data can be used to compute the gpa of the student by using the formula

```
gpa = double(gradepts)/units;
```

The operations include `gpa()`, which computes and returns the GPA, `updateGradeInfo()`, which takes new units and grade points as arguments and updates the grade record, and `toString()` which converts the current status of the grade record to a string in some format. Declare and implement the class `gradeRecord`. You can use `stringstream` or a built-in C function like `sprintf(char *str, char *format, ...)` or `itoa (int value, char *str, int base)` to convert an integer to a string.

### Question 3

Write the free function `dec2bin()` which converts a base-10 integer to a binary number as a vector of bool values (false means 0 and true means 1).

```
vector<bool> dec2bin(int n);
```

For example, the function call `dec2bin(5)` return the vector `<true,false,true>`.