Aim: Understanding “struct” concept, using bit fields, and practising with dynamic allocation.

PreLab: (25 points)
An example program to illustrate both static and dynamic usages of structs:
/* reference: http://www.crasseux.com/books/ctutorial/Initializing-structures.html */

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

struct personal_data
{
    char name[100];
    char address[200];
    int year_of_birth;
    int month_of_birth;
    int day_of_birth;
};

int main() /* To shorten example, not using argp */
{
    struct personal_data person1 =
    {
        "Liddell, Alice",
        "Wonderland",
        1852,
        5,
        4
    };
    struct personal_data person2 =
    {
        "Hale-Evans, Ron",
        "Seattle, Washington",
        1965,
        6,
        27
    };
    struct personal_data* person_ptr1;
    struct personal_data* person_ptr2;
    person_ptr1 = (struct personal_data*) malloc (sizeof (struct personal_data));
    strcpy (person_ptr1->name, "Adams, Douglas");
    strcpy (person_ptr1->address, "The Galaxy");
    person_ptr1->year_of_birth = 1952;
    person_ptr1->month_of_birth = 3;
    /* Don't know his exact birthday */
    person_ptr2 = (struct personal_data*) malloc (sizeof (struct personal_data));

strcpy (person_ptr2->name, "Egan, Greg");
strcpy (person_ptr2->address, "Permutation City");
person_ptr2->year_of_birth = 1961;
/* Don't know his birthday */
puts ("Data contained:");
puts (person1.name);
puts (person2.name);
puts (person_ptr1->name);
puts (person_ptr2->name);
return 0;
/* Any trailing items not initialized by data you specify are set to zero. */
}

Lab:
1. (70 points)
Write a program that uses an “updateTime” function to find the correct time at 30 seconds after the time given as an argument. In your program, you should use the “Time” structure as given below:

```c
struct Time {
    int hour, minute, second;
};
```

```c
void updateTime( struct Time * ); /* function prototype */
```

**For example:**
*If current time is 14:35:45, then updated time will be 14:36:15.*
*If current time is 16:59:52, updated time will be 17:00:22.*
...

2. (30 points)
Write a program that uses an “updateTime2” function to find the correct time at 30 seconds after the time given as an argument. In your program, you should use the “Time2” structure as given below:

```c
struct Time2 {
    unsigned  hour : 5;  /* 24 different unsigned integers can be represented with at least 5 bits*/
    unsigned  minute : 6; /* 6-bit field is used to represent the minutes between 0 and 60 */
    unsigned second : 6; /* 6-bit field to represent the value for the seconds */
};
```

```c
void updateTime2( struct Time2 * ); /* function prototype */
```