Some CPSC 259 Sample Midterm and Final Exam Questions (Part 5)
Sample Solutions

DON'T LOOK AT THESE SOLUTIONS UNTIL YOU'VE MADE AN HONEST ATTEMPT AT ANSWERING THE QUESTIONS YOURSELF.

1. {6 marks} (a) Write C statements (including any declarations) to dynamically allocate an array (using malloc) to hold exactly 300 auto records (structures) each having the following format:

```
struct auto {
int         autoID;
char *      name;
char *      description;
double      price;
};
```

(b) Write a FOR loop to initialize all the `autoID`s in the array according to the following specification: The first element in the array has value 1, the 2nd has value 2, ..., the 300th element has value 3. (Don't write the whole program or the whole function.)

```
      int  k;
```

ANSWERS:

(a):

```
struct auto *  array;

array = (struct auto *) malloc( 300 * sizeof(struct auto) );
```

(b):

```
for (k=0; k < 300; k++)

      array[k].autoID = k+1;

(or:  *(array+k).autoID = k+1; ... or (array+k)->autoID = k+1; )
```

2. {3 marks} Provide the most appropriate Big-O estimate for $T(n) = (n^2 + 30\, n \lg n)(6 + 3 \lg n)$. You *don't* need to show witnesses, and you *don't* need to formally prove your result, but you must justify your answer (e.g., a few words are OK).

ANSWER:

$T(n) = 6n^2 + 3n^2 \lg n + 180\, n \lg n + 90\, n \lg n \lg n$

The largest term is $3n^2 \lg n$, which means that $T(n) \in O(n^2 \lg n)$.

3. {5 marks} What is the output from the following short program? (Write down any assumptions, if you need to make any.) Briefly, show your work.

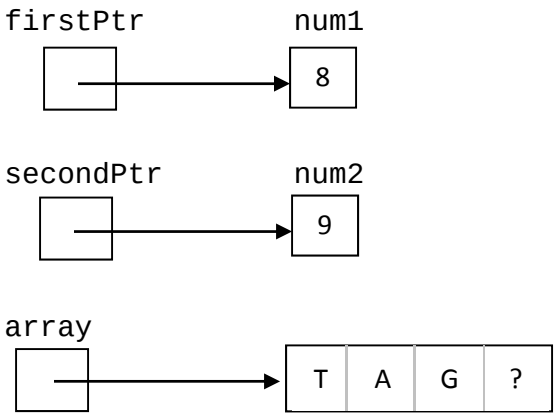
```
#include <stdio.h>
#include <stdlib.h>

double calculations( int a, int * b, double * c);

int main(void)
{
   int     A = 20;
   int     B = 10;      /* assume B has address 200008 */
   double  C = 2.5;     /* assume C has address 200000 */
   double  D;

   D = calculations(A, &B, &C);
   printf("%d %d %.2f %.2f\n", A, B, C, D);

   system("pause");
   return 0;
}


double calculations( int num1, int * num2, double * num3 )
{
   num1  = (int) *num3;
   *num3 = 10 * *num2;

   return (*num3 * num1);
}
```

ANSWER:

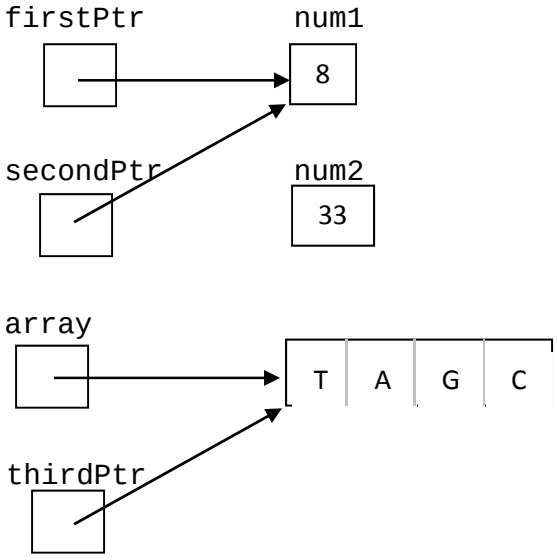
Output: `20  10  100.00  200.00`

4. {5 marks} The following code creates structures represented by the diagrams below:

```
int num1 = 8;
int num2 = 9;
int *firstPtr = &num1;
int *secondPtr = &num2;
char array[4] = {'T', 'A', 'G', '?'};
```



Write the few lines of code necessary to change the above diagrams to the diagrams below, but do not use the variable names `num1` and `num2` in your solution. Carefully note that two data values have been changed below (to 33 and 'C')—in addition to the changes that you can see with respect to the pointers. Write your answer on the right hand side, or below.



ANSWER:

```
char * thirdPtr = array;   /* or  … = &array[0];
                              or  … = (array+0);
                              BUT not … = *(array);    */
*secondPtr = 33;
secondPtr = firstPtr;
array[3] = 'C';
```