ENG EK 125 - Worksheet C Chapter 4B

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1) For the following program, create a document that shows what the output would be, and also explains the output.

```
#include <stdio.h>

void printstuff(void);
int calcans(int);
void myfn(int *, int *);

int main()
{
    int i = 0,
    answer = 9,
    *intptr = &i;
    printf("answer = %d\n",answer);
    printstuff();
    printf("answer = %d\n",answer);
    printf("i = %d\n",i);
    myfn(&i, intptr);
    printf("i = %d\n",i);
    answer = calcans(i);
    printf("i = %d\n",i);
    printf("answer = %d\n",answer);
    return 0;
}

void printstuff(void)
{
    int answer = 33;
    printf("answer = %d\n",answer);
}

int calcans(int num)
{
    num = num * 3;
    return num + 2;
}

void myfn(int *i, int *iptr)
{
    *i = 5;
    *iptr = *i - 1;
}
```

```
OUTPUT:

answer = 9
answer = 33
answer = 9
i = 0
i = 4
i = 4
answer = 14
>>
```

```
EXPLANATION:
int main()
{
    int i = 0,
    answer = 9,
    *intptr = &i;
    printf("answer = %d\n",answer);
    /*
    answer is initialized to be the integer 9, so the first printf statement
    simply prints "answer = 9."
    */
    printstuff();
    /*
    The printstuff() function is called, which returns no values but prints
    "answer = 33."
    */
    printf("answer = %d\n",answer);
    /*
    The next printf statement still produces "answer is 9" because
    the program has left the scope of the printstuff() functions, and
    the original value of answer in the main function has not changed.
    */
    printf("i = %d\n",i);
    /*
    Printing i in the following line yeilds "i = 0" because
    the i was initialized as the integer 0 in the main function.
    */
    myfn(&i, intptr);
    printf("i = %d\n",i);
    /* Print the new value of i after being changed by the pointer variables in myfn()*/
    answer = calcans(i);
    /* i = 4 is passed to calcans. i * 3 = 12 + 2 = 14 = i, so i is now 14.*/
    printf("i = %d\n",i);
    /* The value of i has not changed since the previous printf statement.*/
    printf("answer = %d\n",answer);
    /* Print the new value of answer from calcans*/
    return 0;
}
```

```
void printstuff(void)               // void = returns no values
{
    int answer = 33;                // Creates an integer variable within scope of function
    printf("answer = %d\n",answer); // Prints that variable
}                                   // Terminates all variables created by function

int calcans(int num)
{
    num = num * 3;
    return num + 2;
}

void myfn(int *i, int *iptr)        // void = returns no values
{
    *i = 5;             // The integer 5 is assigned to the address of an integer variable i
    *iptr = *i - 1;
    /* The contents in the address of i - 1 is assigned to the variable of
    the adddress of iptr
    */
}                       // Terminates all variables created by the function
```

2) Given the absolute temperatures T_c of a cold reservoir and T_h of a hot reservoir (in degrees Kelvin), the coefficients of performance (cp) of the refrigeration cycle and heat pump are given by:

$$\text{Refrig cp} = \frac{T_c}{T_h - T_c}$$

$$\text{Heat cp} = \frac{T_h}{T_h - T_c}$$

Write a program that will call a function to prompt the user for the values of T_c and T_h. It then calls a function that calculates the two coefficients of performance. Finally, it calls a function to print the results.

```c
#include <stdio.h>

void calcCP(float, float, float *, float *);
void printres(float, float);

int main(){
    float Tc,
          Th,
          refrigCP,
          heatCP,
          *refrigptr = &refrigCP,
          *heatptr = &heatCP;

    printf("Enter the temperature for a cold reservoir: ");
    scanf("%f", &Tc);
    printf("Enter the temperature for a hot reservoir: ");
    scanf("%f", &Th);

    calcCP(Tc, Th, refrigptr, heatptr);
    printres(refrigCP, heatCP);

    return 0;
}

void calcCP(float Tc, float Th, float *refrigCP, float *heatCP){
    *refrigCP = (float) Tc / (Th - Tc);
    *heatCP = (float) Th / (Th - Tc);
}

void printres(float refrigCP, float heatCP){
    printf("The coefficients of performance of the refrigeration cycle is %.2f.\n", refrigCP);
    printf("The coefficients of performance of the heat pump is %.2f.\n", heatCP);
}
```

```
chena8@WIT45005546 /cygdrive/c/Users/chena8/Documents/College/Fall 
tro to Programming/C/WSC4B
$ ./WSC4B_2
Enter the temperature for a cold reservoir: 35
Enter the temperature for a hot reservoir: 89
The coefficients of performance of the refrigeration cycle is 0.65.
The coefficients of performance of the heat pump is 1.65.
```

3) The two real roots of a quadratic equation $ax^2 + bx + c = 0$ (where a, b, and c are real numbers, and a is nonzero) are given by:

$$(-b + \sqrt{D})/(2 * a) \text{ and } (-b - \sqrt{D})/(2 * a)$$

where the discriminant $D = b^2 - 4*a*c$. (This is true when D >= 0. If D is negative, the roots are complex numbers. You may assume in your program that the roots are real; however, make sure that you enter coefficients for which this will be true!). Write a program that will:

- call a function to prompt the user for the coefficients a, b, and c
- call a function to calculate the discriminant
- call a function to find the roots
- call a function to print the result

```c
#include <stdio.h>
#include <math.h>
#define N 2

void userin(float *, float *, float *);
void calcD(float, float, float, float *);
void calcroots(float, float, float, float, float []);
void dispres(float, float []);

int main(){
    float a,
          b
,         c,
          D,
          roots[N],
          *aptr = &a,
          *bptr = &b,
          *cptr = &c,
          *Dptr = &D;

    userin(aptr, bptr, cptr);
    printf("%.2f %.2f %.2f\n", a, b, c);
    calcD(a, b, c, Dptr);
    calcroots(a, b, c, D, roots);
    dispres(D, roots);

    return 0;
}

void userin(float *a, float *b, float *c){
    printf("Enter the coefficient a: ");
    scanf("%f", &*a);
    printf("Enter the coefficient b: ");
    scanf("%f", &*b);
    printf("Enter the coefficient c: ");
    scanf("%f", &*c);
}

void calcD(float a, float b, float c, float *D){
    *D = pow(b, 2) - 4 * a * c;
}

void calcroots(float a, float b, float c, float D, float roots[]){
    roots[0] = (-b + sqrt(D)) / (2 * a);
    roots[1] = (-b - sqrt(D)) / (2 * a);
}

void dispres(float D, float roots[]){
    printf("The discriminant is %.2f.\n", D);
    printf("The two roots are %.2f and %.2f.\n", roots[0], roots[1]);
}
```

```
chena8@WIT45005546 /cygdrive/c/User
tro to Programming/C/WSC4B
$ ./WSC4B_3
Enter the coefficient a: 1
Enter the coefficient b: 7
Enter the coefficient c: 3
1.00 7.00 3.00
The discriminant is 37.00.
The two roots are -0.46 and -6.54.
```