1. Short Answers (簡答題). 30%

(a) Describe what basic (基本) data types and derived (衍生) data types are.

(b) What is the main difference between do-while and while loop?

(c) Please give example to describe what call by value (傳值呼叫) and call by reference (傳址呼叫) are.

(d) Towers of Hanoi (河內塔) can be solved using recursive program through three steps. Assume there are n disks and three rods, A, B and C, please write the three steps.

(e) Please give example to describe what "Inheritance(繼承)" is in object-oriented programming.

2. What is the output of the following C program? (10%)

```c
#include<stdio.h>
void getResult(int a[]){
    for(int i=0; i<5; i++){
        if( (a[i]%2) == 0 && a[i] > 20)
            printf("%d ", a[i]-1);
    }
};

int main(){
int a[] = {20, 30, 50, 76, 66};
getResult(a);
return 0;
}
```

3. What is the output of the following C program? (15%)

```c
#include <stdio.h>
#include <stdlib.h>
int main(void) {
int i, j;
int total = 0, subtotal;
  int grades[4][2] = {{ 20, 40 },   { 60, 80 },   { 80, 60 }, { 40, 20 } };
    for ( j = 0; j < 2; j++ ){
        subtotal = 0;
        for ( i = 0; i < 2; i++ ){
                printf("|%d|", grades[j][i]);
                subtotal += grades[j][i];
                total += grades[j][i];
        }
        printf(" ==>小計: %d\n", subtotal);
    }
    printf("Total: %d\n", total);
    return 0;
}
```

4. What is the output of the following C program? (15%)

```c
#include <stdio.h>
int transformHour(int hour);
int main(void) {
    char m;
    int hour;
    printf("Enter a number between 0 to 24 => ");
    scanf("%d", &hour);
    /*Assume 13 is entered*/
    m = (hour >= 12) ? 'P' : 'A';
    hour = transformHour(hour);
    printf("Current time is %d: %c\n", hour, m);
    return 0;
}
int transformHour(int hour){
    hour = (hour >= 12) ? hour-12 : hour;
    return hour;
}
```

5. What is the output of the following C program? (15%)

```c
#include <stdio.h>
#include <stdlib.h>
int main(void) {
    char str[16] = "This is a book.";
    char str1[16];
    char *ptr1, *ptr = str;
    int i = 0;
    ptr1 = str1;
    while ( *ptr != '\0' ) {
        if(i%2 ==0) *(ptr1+i) = *(ptr++);
        else{
            *(ptr1+i) = '_';    ptr++;
        }
        i++;
    }
    *(ptr1+i) = '\0';
    printf("ptr1 = %s\n", ptr1);
    return 0;
}
```

6. Correct the errors of the following JAVA program using Exception. (15%) (Hit: ArithmeticException)

```java
public class expectionHandling {
    static int num = 50;
    static int[] denominator = {0, 25, 50};
    static String answer;
    public static void main(String[] args) {
        for(int i=0; i< denominator.length; i++)  calc(i);
    }

    public static void calc(int index) {
        double ans = 0;
        ans = numerator / denominator[index];
        answer = String.valueOf(ans);
    }
}
```