Name: _____ *Student ID:* _____

Section A

1. Consider the following program.

```
static int find (int list[], int n, int key)
{
    //binary search of ordered list
    int lo = 0, mid;
    int hi = n - 1;
    int result = -1;
    while ((hi >= lo) && (result == -1))
    {
        mid = (lo + hi) / 2;
        if (list[mid] == key)
            result = mid;
        else if (list[mid] > key)
            hi = mid - 1;
        else // list[mid] < key
            lo = mid + 1;
    }
    return result;
}
```

   a. Draw the Data Flow Graph (DFG) for the *find* function. **[05%]**
   b. Give the definition of the du-pair. Identify all the du-pairs for variables *lo*, *hi*, and *result* in the *find* function and specify their use (p- or c-). **[12%]**
   c. Define 100% All-definitions data flow coverage. Using this definition, specify the test cases for variables *hi*, *lo*, and *result*. Explain what principles you have used to generate your test cases. **[15%]**
   d. Write out time-sequence pairs for variables *mid*, *lo*, and *result*. What conclusion can you draw on their basis? **[09%]**

2. Given the hours (hours), and hourly pay rate (rate), the program calculates pay as hours times rate if the values for hours and rate are valid. The program displays the message "Invalid hours" if the value for hours is not between 1 and 40 inclusive. The program displays the message "Invalid rate" if the value for rate is not between 10 and 25 inclusive. The program always checks both the hours and the rate.

   a. Specify how many tests will be required to ensure Code Coverage. Explain how you have arrived at the number of tests. **[05%]**
   b. Construct a Decision Table for testing software developed according to the above problem description. **[10%]**

Dr. Mónica Villavicencio, Dr. Carlos Mera Gómez

c. Specify the test cases according to the Decision Table you have constructed in part (b) and **check the boundary values**. Explain in detail what principles you have used to generate your test cases. Use a simple form of test case specification, i.e., a table with the following headings. **[20%]**

Test case ID	Input values	Expected results

Section B

3. The following statement refers to decision coverage: **[03%]**

"When the code contains only a single 'if' statement and no loops or CASE statements, and its execution is not nested within the test, any single test case we run will result in 50% decision coverage."

Which of the following statement is correct?

a. The statement is true. Any single test case provides 100% statement coverage and therefore 50% decision coverage.
b. The statement is true. Any single test case would cause the outcome of the "if" statement to be either true or false.
c. The statement is false. A single test case can only guarantee 25% decision coverage in this case.
d. The statement is false. The statement is too broad. It may be correct or not, depending on the tested software.

Select ONE option.

4. An employee's bonus is to be calculated. It cannot be negative, but it can be calculated down to zero. The bonus is based on the length of employment: **[03%]**
   - Less than or equal to 2 years
   - More than 2 years but less than 5 years
   - 5 to 10 years inclusively
   - Longer than 10 years

What is the minimum number of test cases required to cover all valid equivalence partitions for calculating the bonus?

a. 3
b. 5
c. 2
d. 4

Select ONE option.

Dr. Mónica Villavicencio, Dr. Carlos Mera Gómez

5. A speed control and reporting system has the following characteristics: **[03%]**
   - If you drive 50 km/h or less, nothing will happen.
   - If you drive faster than 50 km/h, but no more than 55 km/h, you will be warned.
   - If you drive faster than 55 km/h but not more than 60 km/h, you will be fined.
   - If you drive faster than 60 km/h, your driving license will be suspended.
   - The speed in km/h is available to the system as an integer value.

   Which would be the most likely set of values (km/h) identified by applying the boundary value analysis, where only the values on the boundaries of the equivalence classes are selected?

   a. 0, 49, 50, 54, 59, 60
   b. 50, 55, 60
   c. 49, 50, 54, 55, 60, 62
   d. 50, 51, 55, 56, 60, 61

   Select ONE option.

6. A video application has the following requirement: The application shall allow playing a video on the following display resolution: **[03%]**
   1. 640x480
   2. 1280x720
   3. 1600x1200
   4. 1920x1080

   Which of the following list of test cases is a result of applying the equivalence partitioning test technique to test this requirement?

   a. Verify that the application can play a video on a display of size 1920x1080 (1 test case)
   b. Verify that the application can play a video on a display of size 640x480 and 1920x1080 (2 test cases)
   c. Verify that the application can play a video on each of the display sizes in the requirement (4 test cases)
   d. Verify that the application can play a video on any one of the display sizes in the requirement (1 test case)

   Select ONE option.

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Section C

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7. Suggest appropriate reliability metrics for the classes of software system below. Give reasons for your choice of metric. **[12%]**
   a. a system that monitors patients in a hospital intensive care unit.
   b. a word processor.
   c. an automated vending machine control system.
   d. a system to control braking in a car.
   e. a system to control a refrigeration unit.
   f. a management report generator.

Dr. Mónica Villavicencio, Dr. Carlos Mera Gómez