# University of Asia Pacific
## Department of Computer Science & Engineering
## Mid-Semester Examination Fall -2020
## Program: B. Sc Engineering (2nd Year/ 2nd semester)

**Course Title:** Algorithms      **Course No.** CSE 207      **Credit:** 3.00

**Time:** 1.00 Hours.      **Full Mark:** 60

There are **Three (3)** Questions. Answer all of them. All questions are of equal value. Figures in the right margin indicate marks.

1. **a)** Given the algorithm below, find the **Time Complexity**. Here, *id* is your registration number. Show the **detailed steps** of your calculation.    [12]

   ```
   fun(a[m], b[n])
      for( i = 1; i <= m; i++)
        if ( id is even )
           for( j = 1; j <= n; j = 2*j)
              if( a[i] = = j)
                  return j
        else
           for(j = 1; j*j <= n; j++)
              if(b[j] = = i)
                  return i

      return -1
   ```

   **b)** For the algorithm in Q1a, provide example value of **a[m]**, and **b[n]** for both **Best case** and **Worst-case** scenario. The size of a and b will depend on your registration number. Use the following formula to calculate **m** and **n**.    [8]

   m = 6 +last 2 digits of your registration number%3
   n = 8 + last 2 digits of your registration number % 3

   Or,

   **b)** Solve the following recursive Time Complexity equation using Master Theorem.    [8]

   $$T(n) = aT(n/3) + cn^p$$

   where a = 3*(last 2 digits of your registration number % 3 + 1)
   p = last 2 digits of your registration number % 4

**2. a)** Greedy algorithm doesn't provide optimal solution for all problems. A problem must have few properties to be solvable by Greedy algorithm. Mention what those properties are and briefly describe those properties. [10]

**b)** You are playing a game in a party. There are n balloons and one of them has a gemstone inside it. You are asked to find the balloon with the gemstone in it. Write an *O(logn)* **divide and conquer** algorithm to locate/find the balloon with the gemstone. [10]

Hints:
1) Balloon with the gemstone will be heavier than the other balloons.
2) Dividing the balloons into 2 halves will give you a clue which pile has the balloon with gemstone.

**3.** Determine the Maximum Subarray Sum using the **Divide and Conquer** approach for the following data— [20]

| 11 | -2 | 16 | A | 16 | -7 | 12 | -B | 3 |

Here, A is the last digit of your ID.
B is the second last digit of your ID.

For example, if your ID is 113058, then, A = 8 and B = 5.

Or,

**3.** Illustrate the **activity selection** problem for the following scenario— [20]

| Activity | Starting Time | Finish Time |
|----------|---------------|-------------|
| I | 5 | 9 |
| II | A | B |
| III | C | D |
| IV | 3 | 4 |
| V | 0 | 6 |
| VI | 8 | 9 |

Here, A is your ID mod 3. B = A+3. C is your ID mod 7. D = C+2.

Will this approach always give the optimal solution?
What do you think? explain your answer.