UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

UCSC

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Academic Year 2016/2017 – Second Year Examination – Semester II – 2019

SCS2210 – Discrete Mathematics II

TWO (2) HOURS

Important Instructions to candidates:

1. The medium of instruction and questions is **English**.
2. **Write your answers** in **English.**
3. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
4. Note that questions appear on both sides of the paper. If a page is not printed, please inform the supervisor immediately.
5. Write your index number on each and every page of the answer paper.
6. This paper has **4** questions and **02** pages.
7. Answer **ALL** questions. All questions carry equal marks (**25** marks).
8. Any electronic device capable of storing and retrieving text including electronic dictionaries and mobile phones are **not allowed**.
9. **Non-Programmable** calculators are **allowed**.

1. (a) Show that any composite three-digit number must have a prime factor less than or equal to 31.

   (b) Employing the Eratosthenes method, obtain all the primes between 100 and 200.

   (c) A man has 987 oranges. In how many ways can he distribute these among 13 women and 5 children if all women receive equal number of oranges and all children receive equal number of them? (Formulate a suitable linear Diophantine equation and solve it accordingly.)

2. (a) Use congruence relation to prove $41|2^{20}-1$.

   (b) Use the Euclidean algorithm to compute $d = gcd(3672, 1566)$. Write d as an integer linear combination of 3672 and 1566.

   (c) A troop of 17 monkeys store their bananas in 11 piles of equal size, each containing more than one banana, with a twelfth pile of 6 left over. When they divide the bananas into 17 equal piles, none are left over. What is the smallest number of bananas they can have? (Formulate a suitable system of linear congruences and solve it accordingly.)

3. (a) Suppose that a pizza can have non-vegetables toppings and\or vegetable toppings. The non-vegetables toppings can be fish, chicken, sausage, and hamburger; and the vegetable toppings can be tomato, mushroom, pickle, onion, green pepper and olive. A pizza can have from zero to all ten of these toppings.

      i. How many different pizzas can be ordered?

      ii. How many different pizzas contain no vegetables?

      iii. How many different pizzas contain at most one non-vegetables topping?

   (b) A collection of at least three yellow flags, three blue flags, three maroon flags, three red flags, and three green pegs is available.

      i. How many ways are there to arrange three colored flags (without repetition) in a row?

      ii. How many ways are there to choose three colored flags (with repetition) from the collection?

4. (a) Find the next two terms in the sequence $3, 5, 11, 21, 43, 85, \cdots$. Then give a recursive definition for the sequence. Finally, use the characteristic root technique to find a closed formula for the sequence.

   (b) Let a_n be the number of $1 \times n$ tile designs you can make using 1×1 squares available in 4 colors and 1×2 dominoes available in 5 colors.

      i. First, find a recurrence relation to describe the problem. Explain why the recurrence relation is correct (in the context of the problem).

      ii. Write out the first 6 terms of the sequence. Solve the recurrence relation. That is, find a closed formula for a_n.