SFWRENG 3BB4 – Software Design III
Concurrent System Design

Assignment 1

Due date: Friday, September 30, 2016, 11:59pm (EDT)

Instructions: Please read the questions carefully. Solutions must be submitted in the Avenue Dropbox created for the assignment. Note that the deadline is strictly enforced. Avenue tracks the exact time that submissions are uploaded and late submissions may be rejected.

Question 1

Part A Implement in Java a program consisting of two threads such that: (i) The first thread repeatedly chooses between printing the character `a` one time or the character `b` two times; (ii) the second thread repeatedly prints the character `c` one time followed by the character `d` one time.

Part B Let s be the stream be the stream printed by the Java program of the previous part, can you identify any non-trivial pattern in s? Explain your answer.

Question 2

Part A Implement in Java a program consisting of three threads such that: (i) The first thread repeatedly prints the character `a` one time if the number of times it has printed this character in the past is a multiple of three, or the character `a` two times if the number of times it has printed this character in the past is not a multiple of three; (ii) the second thread repeatedly prints the character `b` two times if the number of times it has printed this character in the past is not a multiple of three, or the character `b` one time if the number of times it has printed this character in the past is a multiple of three; (iii) the third thread repeatedly prints the character `c` three times.

Part B Let s be the stream be the stream printed by the Java program of the previous part, can you identify any non-trivial pattern in all $s[(i*6)\ldots((i*6)+5)]$?[†] Explain your answer.

[†]For a stream s, $s[i\ldots j]$ is the sub-stream of s that starts at index i and that ends at index j (with 0 the lowest possible index).

Question 3

Part A Modify the Java program of Question 2 Part A so that the three threads it involves synchronize to satisfy that: For all i, $|s[(i*6)\ldots((i*6)+5)]|_{\mathtt{a}} + |s[(i*6)\ldots((i*6)+5)]|_{\mathtt{b}} = |s[(i*6)\ldots((i*6)+5)]|_{\mathtt{c}} = 3$ (for s the stream printed by the Java program resulting from the modification).[‡]

Question 4

Part A Model the Java programs of Questions 1 to 3 as FSP processes in CLTSA.

[‡]For a stream s and a character c, $|s|_c$ equals the number of times that c appears in s.