First Semester Examination	Course Instructor – Ngatchu Damen
SIT333 – Systems Programming	Time Allowed – 3 hours

Instructions – Answer question 1 and any other two questions. Penalty for wrong English and poor presentation of answers. Code fragment are and should be written in the Java Programming Language.

Question 1 (20marks)

(a) What is a distinctive characteristic of systems programming? **(2marks)**
(b) Why is JAVA not suitable for systems programming? **(2marks)**
(c) Distinguish between Linux Character and Block hardware devices **(2marks)**
(d) Briefly describe the concept of interrupts as used in systems programming **(2marks)**
(e) Explain the problem of data coherence with shared memory. **(2marks)**
(f) What are two advantages of creating a byte-for-byte correlation with some portion of a file or file-like resource? **(2marks)**
(g) what is an advantage of pipes over named pipes and of named pipes over pipes? **(2marks)**
(h) Briefly describe how synchronous message passing can be implemented over asynchronous messaging system and vice versa. **(2marks)**
(i) What distinguishes a signal from an interrupt? **(2marks)**
(j) What are semaphores? **(2marks)**

Question 2 (15marks)

Working with libraries is one of the best ways in which Java integrates codes written in native (other) programming languages. The exhibits shown below come from a demonstration project of JNI. Study them carefully and answer the questions that follow.

```
// The Bessel.java file
public class Bessel
{
// Declaration of the Native (C) function
 private native double bessely0(double x);
 static
 {
  // The runtime system executes a class's static initializer
  // when it loads the class.
  System.loadLibrary("CJavaInterface");
 }
// The main program
public static void main(String[] args)
{
 double x, y;
 int i;
 /* Check that we've been given an argument */
 if (args.length != 1)
 {
   System.out.println("Usage: java Bessel x");
   System.out.println(" Computes Y0 Bessel function of argument x");
   System.exit(1);
 }
// Create an object of class Bessel
 Bessel bess = new Bessel();
 /* Convert the command line argument to a double */
 x = new Double(args[0]).doubleValue();
 System.out.println();
 System.out.println("Calls of Y0 Bessel function routine bessely0");
 for (i = 0; i < 10; i++)
 {
   /* Call method bessely0 of object bess */
   y = bess.bessely0(x);
   System.out.println("Y0(" + x + ") is " + y);
   /* Increase x and repeat */
   x = x + 0.25;
 }
}
}
```
EXHIBIT A

```
/* The Bessel.h file generated from */
/* the Bessel class by the javah tool. */
/* DO NOT EDIT THIS FILE - it is machine generated */
#include <jni.h>
/* Header for class Bessel */
#ifndef _Included_Bessel
#define _Included_Bessel
#ifdef __cplusplus
extern "C" {
#endif
/* Class: Bessel
 Method: bessely0
 Signature: (D)D */

JNIEXPORT jdouble JNICALL Java_Bessel_bessely0
(JNIEnv *, jobject, jdouble);
#ifdef __cplusplus
}
#endif
#endif
```
EXHIBIT B

```
/* The BesselImp.c file,which implements the native function */
/* Java Native Interface headers */
 #include <jni.h>
/* Auto-generated header created by javah -jni */
 #include "Bessel.h"
/* Include math.h for the prototype of function y0 */
 #include <math.h>


 JNIEXPORT jdouble JNICALL
 Java_Bessel_bessely0(JNIEnv *env, jobject obj, jdouble x)
 {
   double y;


   y = y0(x);
   return y;
 }
```
EXHIBIT C

(a) What native programming language is used in the project? **(1mark)**

(b) From EXHIBIT A , what is the role of private native double bessely0(double x); do? **(2marks)**

(c) Under what circumstances is the programmer allowed to make modifications in the file shown in EXHIBIT B ? **(2marks)**

(d) The syntax JNIEXPORT jdouble JNICALL Java_Bessel_bessely0(JNIEnv *env, jobject obj, jdouble x) appears in EXHIBIT B and EXHIBIT C . Why? **(2marks)**

(e) What does the program do? **(3marks)**

(f) What modifications will you make on the codes such that it computes the sine of 10 angles which are 36 degrees apart **(5marks)**

Question 3 (15marks)

Study the diagram below represents state transition for programs in Java. Study it carefully and answer the questions that follow.
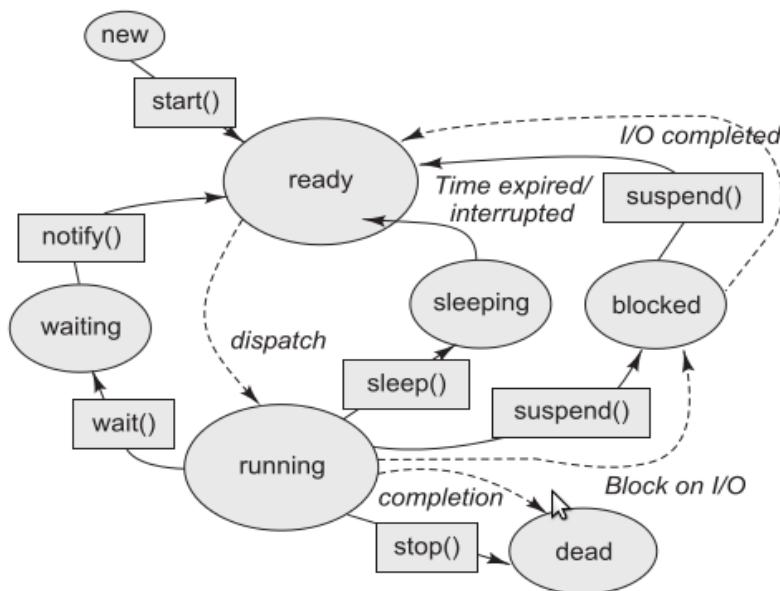
(a) With respect to computer programming, what is a state? **(1mark)**

(b) What are the characteristics of a program in the READY and RUNNING states **(4marks)**

(c) Describe four of the transitions to the READY state, stating explicitly, under what circumstances they occur. **(8marks)**

(d) Describe two current issues with threads and concurrent programming. **(2marks)**

Question 4 (15marks)

In a certain software engineering project, it is required that both server and client software should be able to exchange data. The server is written in Java but the client could be coded in any other programming language. Assuming that XML is used for the data exchange and in a particular scenario, the server should send to clients, the contact information (name and phone number) of individuals, identified by their national ID card numbers. answer the following questions.

(a) State four other technologies which belong to the XML family. **(4marks)**

(b) Propose a document type definition for the XML documents. **(4marks)**

(c) Based on your answer in (b) above, write a sample XML document **(4marks)**

(d) What are three components of a Java code that can analyze such files? **(3marks)**