DHAKA UNIVERSITY
CSE-3201: SOFTWARE DESIGN PATTERNS
Time: 1.00 hr
Total: 70
Year: 3rd
INSTRUCTOR: MOIN MOSTAKIM

In Course Exam

Name: **Hosneara Ahmed** Roll: **SN-17**

- Answer All

1. (10 points) Question 1

(a) Differentiate between Object Oriented Programming and Design? 4 pts

(b) Differentiate between Class and Object diagram with an example? 4 pts

(c) Write down the classification of "Design Patterns" according to GOF? 2 pts

2. (20 points) Question 2

The Aeroporter Transport Services Company runs a limousine service that carries passengers to and from the Toronto airport to their homes or places of business. They maintain a database of customers on a PC in order to schedule pickups and also to keep their customers from having to repeat address information each time they call the limousine service. The database for the customers is accessed by customer telephone number. If a customer is picked up sometimes at their home and sometimes at their office, both home and office telephone numbers and addresses are stored in the database. The customer may also schedule a pickup from the airport when his or her flight arrives or may call from the airport and reserve a limousine which will come in approximately five minutes.

When a request for a pickup comes in, the dispatcher checks for available drivers, calls one and assigns them to a customer. Typically cars are assigned to the driver each workday and often a driver will take a car home for an early morning pickup if needed.

(a) Draw necessary class diagram? 10 pts

(b) Identify which design patterns could be used here? 5 pts

(c) Explain is it possible to use composite structure design pattern in the above scenario 5 pts

3. (20 points) Question 3

"A framework needs to standardize the architectural model for a range of applications, but allow for individual applications to define their own domain objects and provide for their instantiation."

(a) Which design pattern is the statement referring? 5 pts

(b) Classify the pattern with GOF classification? 2 pts

(c) Differentiate it with any classified design pattern? 3 pts

(d) Draw the class diagram with an example? 10 pts

4. (20 points) Question 4

A major penal centre has been built outside the town of Queenston for keeping prisoners convicted of only one offense or of white collar crimes. The prison facility has a constant flow of prisoners into and out of the prison They are also moving prisoners within the prison based on their good behaviour. On a day to day basis, approximately 136 prisoner changes take place. The changes are processed in the prison control centre office by Miss Keepkey. Each day, the new prisoner processing division receives the new prisoners, conducts a physical examination, assigns the prisoners to living quarters and sends the information file on the new prisoners to Miss Keepkey's office. Miss Keepkey adds information on the new prisoner to a prisoner information database kept on her PC. She also updates her prisoner locator log which keeps records of where each prisoner resides. Finally, she files the actual folder away in an enormous storehouse of file cabinets which contains information on all prisoners who have ever stayed at Queenston. If a new prisoner is found to have been a previous occupant of Queenston, she consolidates both files. As prisoners stay at Queenston, the officials review their behaviour record. Good behaviour or closeness to release time warrant an upgrade in accommodations, usually to minimum security housing. Movement of prisoners to new quarters is done on a weekly basis. Orders are issued to move the prisoners and the move information is sent to Miss Keepkey. She makes these changes in her prisoner locator log and her prisoner information database. She also pulls the prisoners long term file and notes good behavior commendations. A release review and parole board reviews prisoner records on a daily basis and generates a set of prisoners to be released either into the custody of a parole officer or without any restrictions. They notify the prisoner and send an update of the release to Miss Keepkey'soffice. She removes the prisoner from her prisoner information database and prisoner locator log and updates the long-term file of the prisoner to reflect the release.

(a) Design a work process for Miss Keepkey's?   5 pts

(b) Classify the design patterns?   5 pts

(c) Draw the class diagram with necessary components?   10 pts

CSE 3205 Mathematics for Computer Science

In-course Examination 2016

Answer the following questions.

1. [5 marks] Show that if A is a wide matrix with independent rows then AA^T is invertible and the right inverse of A is given by the pseudo-inverse $A^T(AA^T)^{-1}$.

2. [5 marks] Suppose we have the following is an augmented matrix $[A:b]$ of a system of linear equations and its reduced row echelon form R.

$$\begin{pmatrix} 1 & 3 & -2 & 0 & 2 & 0 & 0 \\ 2 & 6 & -5 & -2 & 4 & -3 & -1 \\ 0 & 0 & 5 & 10 & 0 & 15 & 5 \\ 2 & 6 & 0 & 8 & 4 & 18 & 6 \end{pmatrix} \qquad \begin{pmatrix} 1 & 3 & 0 & 4 & 2 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/3 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$[A:b] \qquad\qquad\qquad\qquad R$$

(i) Write down the system of linear equation in terms of variables x_i.

(ii) What is the row space and column space of A?

(iii) Is the system consistent or not? Why or why not? if consistent, is the solution unique? Why or why not. Write down the unique or general solution, if the system is consistent.

3. [5 marks] Show that for two 2x2 matrices U and V, $<U,V> = tr(U^T V)$ is an inner product on the space of all 2x2 real matrices. Using this inner product define two matrices that are orthogonal but not orthonormal. And then find the norms of those matrices.

4. [5 marks] Let $f(t)$ and $g(t)$ be defined for $t \geq 0$, then the convolution of the functions f and g are defined as
$$(f * g)(t) = \int_0^t f(\tau)g(t - \tau)d\tau$$
Show that if $L\{f(t)\} = F(s)$ and $L\{g(t)\} = G(s)$ then $L\{(f * g)(t)\} = F(s)G(s)$

5. [3 x 10 = 30 marks] Answer **any three** of the following questions.

a. Find the QR decomposition for the following matrix. Are the columns of the matrix linearly independent?

$$\begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

b. Find the Fourier series representation of the following function. Find the explicit values of a_i's and b_i's for $i = 0, ..., 4$.

$$f(x) = \begin{cases} sin2x, & -\pi < x < -\pi/2 \\ 0, & -\frac{\pi}{2} \leq x \leq 0 \\ sin2x, & 0 < x \leq \pi \end{cases}$$

c. Solve the initial value problem $y'' + 4y' + 13y = 2e^{-2t} \sin 3t$ with $y(0) = 1$ and $y'(0) = 0$.

[Hint: you may find the formula in question 5 useful.]

d. For the following system of linear equation find the solution using LU decomposition.

$$2x_1 + x_2 + x_3 = 5$$
$$4x_1 - 6x_2 = -2$$
$$-2x_1 + 7x_2 + 2x_3 = 9$$

INCOURSE EXAMINATION

3rd Year 2nd Semester B. Sc. (Hons.) 2016

Department of Computer Science and Engineering, University of Dhaka

CSE – 3202: Computer Network   Duration: 1.5 Hours   Marks: 30

(Answer **All** the following questions)

1.
   a) What is a socket? Why is it required to transfer a message in the Internet?   2
   b) What are cookies? List down the advantages and disadvantages of using cookies.   2
   c) How can you determine the route taken by packets flowing from **cse.univdhaka.edu** to **www.download.com** ? How can you determine the round-trip-time between them?   2
   d) What is queuing delay? What causes it to increase? Briefly describe the effects of increasing queuing delay.   2
   e) Describe how web caching can reduce the delay in receiving a request object. Will web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?   2

2.
   a) As you know, the TCP has a 32-bit sequence number field for uniquely identifying the transmitted segments. Suppose that a process in Host **A** wants to send a stream of data to a process in Host **B** over a TCP connection. Also, suppose that the data stream consists of a file of 800,000 bytes, that the MSS is 1536 bytes, and that the first of the data stream is numbered zero.
      (i) Calculate the total number of transmitted segments.   2
      (ii) What will be the assigned sequence number for the 10th segment? Calculate.   2
      (iii) What will be the acknowledgement number of the ACK packet transmitted by Host **B** on reception of the 10th segment? Calculate.   2
   b) It has been said that flow control and congestion control are equivalent. Is this true for the Internet's connection-oriented service? How do the objectives of flow control and congestion control differ from each other?   2
   c) Why does TCP/IP perform error checking both in the transport and data link layers?   2

3.
   a) How does tunneling help IPv6 hosts to communicate over IPv4 networks?   2
   b) Consider the following plot of TCP window size as a function of time.
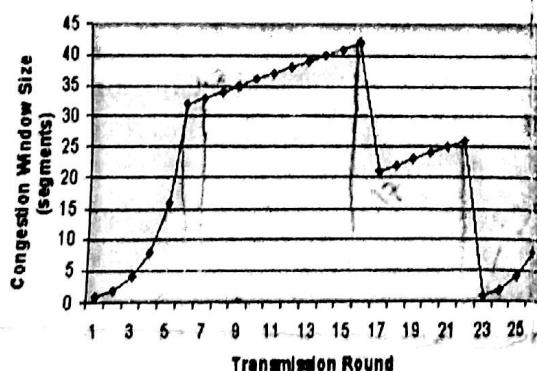
   (i) Determine whether the above graph represents the behavior of TCP Reno or TCP Tahoe.   1
   (ii) What is the value of threshold at the 9th and 20th rounds?   1
   (iii) After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? Why?   1
   (iv) During what transmission round the 70th segment is sent?   1

   c) Suppose that your organization purchased a large network 200.100.0.0/16 and eight organizations named **A** through **H** request approximately 1000 IP addresses each. For these organizations, calculate the network addresses, first IP address assigned and the subnet mask in w.x.y.z/s notation.   2
   d) How does the operation principle of OSPF routing protocol differ from that of a RIP protocol?   2
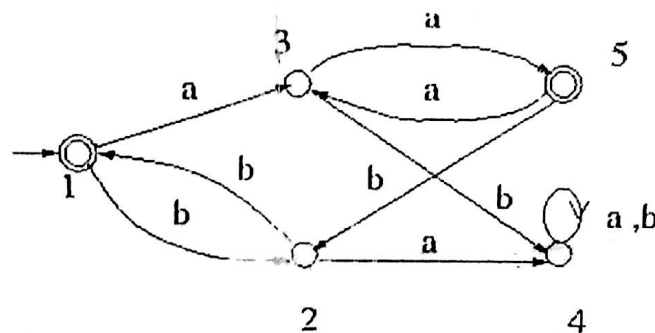
Answer the following questions.

1. a. Consider the following language ($\Sigma = \{a, b\}$)   5
L={w | w contains an even number of a's and an odd number of b's and does not contain the substring ab}
Draw a **5-state** DFA for the language

   b. Consider the CNF grammar   5

$$S \to AS|SB|0|1$$
$$A \to AA|0$$
$$B \to BB|1$$

   Use CYK algorithm to show whether the string 011000 belongs to the language of the above grammar.

2.

   a. Minimize the above DFA.   3

   b. Construct regular expression for the minimized DFA using one of the two methods taught in the class.   4

   c. A string x is a prefix of a string y if a string z exists where $xz = y$, and that x is a proper prefix of y if in addition $x \neq y$. Let, A be a regular language and we define a new language B as follows   3
B={ w | w $\in$ A but w is not a proper prefix of any string in A }
If $M = (Q, \Sigma, \delta, q_0, F)$ is the DFA recognizing A, construct the DFA M' that will recognize B.

3. a. When are two states in a DFA distinguishable? Let D be a relation such that D = {(s,t)| s and t are distinguishable}. Is the relation D reflexive, symmetric, anti-symmetric, or transitive? Explain.   4

   b. Convert the following CFG into CNF.   6

$$S \to aAa \mid bBb \mid c$$
$$A \to C \mid a$$
$$B \to C \mid b$$
$$C \to CDE \mid \epsilon$$
$$D \to A \mid B \mid ab$$

3rd Year 2nd Semester 2016
In-course Exam
CSE-3204: System Programming
Full Marks: 50, Time: 90 minutes
Attempt all questions.

Student Id:_____   Student Name: _____

Question-1

a) What is a daemon process? Mention the steps for a program to become a daemon. Write a C
program to implement the following function.   [1+3+3 = 7]

```
include<unistd.h>
int daemon (int nochdir, int noclose);
```

Description: If *nochdir* is nonzero, the daemon will not change its working directory to the root
directory. If *noclose* is nonzero, the daemon will not close all open file descriptors. Otherwise
daemon shows its default characteristics (both *nochdir* and *noclose* are zero). On success, the call
returns 0. On failure, the call returns -1, and *errno* is set to a valid error code .

b) State the differences between child and parent processes? What will be the output of the
following program? Provide reasons behind your assumption.   [3 + 2 = 5]

```
#include <unistd.h> /*fork declared here*/
#include <stdio.h> /* printf declared here*/

int main() {
  int answer = 84;
  printf("Answer: %d", answer);
  fork();
  return 0;
}
```

c) Distinguish between *Effective User ID* (EUID) and *Real User ID* (RUID).Write down the
equivalent system calls for *wait* and *waitpid* using *wait4* system call.   [1 +2 =3]

d) Write down the system call(s) with its parameters and return information to manipulate each
of the following tasks.   [5 x 1 = 5]

	Task to do
i.	Creating a symbolic Link
ii	Creating a FIFO
iii	Synchronizing a file's contents to disk
iv	Changing owner and group of a file
v	Implementing *fork*, *dup*, *exec*, *pipe* together

Question-2

a) What are the advantages of *unnamed pipe* over *named pipe*? Implement the following command using *dup2* and *pipe2*.   [2 + 4= 6]

b) What do you understand by *inter-process* communication via shared address space? How do the processes communicate via a shared file using mapped memory? Illustrate the scenario using a proper diagram.   [2 + 3 =5]

c) What is the purpose of using *msync*()? Implement *wait()* operation of a binary semaphore using **Process Semaphore.**   [1 + 3 = 4]

Question-3

a) Demonstrate Multiplexed I/O. Why it is required? Give an example scenario of applying Multiplexed I/O [Note: Implementation is not required.].   [2 +2 = 4]

b) Design a **file monitoring** application program to watch a directory *"/home/user"* for monitoring the following events.   [7 x 1 = 7]
        (i) Creation of new files
        (ii) Modification to existing files
        (iii) Changing permission of files
You are required to use following system calls. Use appropriate **watch masks** and **macros** to trace the above events. Print messages stating the events occurred in the mentioned directory.

Include header file: "inotify.h"	
System Calls	Purpose
1.	int *inotify_init* (void);	Initializing *inotify*
2.	int *inotify_add_watch* (int fd, const char *path,uint32_t mask);	Adding a new watch
3.	int *inotify_rm_watch* (int fd, uint32_t wd);	Removing an *inotify* watch

c) State the characteristics and applications of *read*(), *readv*() and *pread*()."In Unix, all read operations are synchronous and synchronized whereas all write operations are synchronous and non-synchronized." Explain.   [2 + 2 = 4]

Student Id: _____   Student Name:_____

Q1. What is UMASK? Why it is required? What will be the permission mode of the file after the execution of following code if UMASK is **045**?

```
int fd;
fd = open (file, O_WRONLY | O_TRUNC, S_IWUSR | S_IRUSR | S_IXGRP);
```
Ans.

Q2. Compare *Vectored I/O* and *Linear I/O*. "In Unix, all read operations are *synchronous* and *synchronized* whereas all write operations are *synchronous* and *non-synchronized*." Explain.

Q3. What is memory mapped I/O and Why it is needed? Describe the parameters of *mmap()* system call which provides memory mapped I/O.

Q4.Mention the *read()* system call characteristics when there will be no data available to read. Explain the scenario for both blocking and non-blocking mode.

CSE:3213 System Programming
Quiz-1 Set: R
Marks:20 Time: 30 Minutes
Attempt All Questions

Student Id: _____   Student Name:_____

Q1. List the differences between *poll* and *select*. What is page write-back? What is happening in the following code?

```
off_t ret;
ret = lseek (fd, 50, SEEK_END);
if (ret == (off_t) -1)      /* error */
```

Q2. Define Hard link and Soft Link. List the system calls available to create these links.

Q3. How Linux kernel handles file monitoring events? Write down the tasks performed by each of the following system calls.

 (i) *inotify_init(),* (ii) *inotify_add_watch()* and (iii) *inotify_rm_watch().*

Q4. Effects of unlink(path) system call when path is a -

(i) regular-file:

(ii) hardlink:

(iii) symlink:

CSE:3213 System Programming
Quiz-1 Set: M
Marks:20 Time: 30 Minutes
Attempt All Questions

Student Id: _____   Student Name:_____

Q1. What is the purpose of using *rename()* system call? Can you implement it using *link()* and *unlink()* system calls?

Q2.State the difference between *fsync()* and *fdatasync()*? How *pread()* and *pwrite()* prevent race condition to occur?

Q3.What do you understand by Multiplexed I/O? Describe any system call which provides Multiplexed I/O.

Q4. Fill up the following table with appropriate information.

Effects of *rename(scr, dest)* system call:

scr/dest	File	Link
File		
Link		

CSE:3204 System Programming
Quiz-2 Set: M
Marks:15 Time: 30 Minutes
Attempt All Questions

Student Id: _____   Student Name:_____

Q1. What do you understand by the Masking of signal(s)? Write down an example program to mask SIGINT and SIGTERM using `sigprocmask()`.

Q2. What are the purposes of using `sigpending` () and `sigismember`()?Write down the equivalent call of `raise`(signo) using `kill`() ?

Q3. Consider the following program and sequence of commands to execute.

$kill -SIGQUIT parent_pid
$kill -SIGQUIT child_pid

Parent.c	Child.c	Output with Explanation

#include <stdio.h>
#include <unistd.h>
#include <signal.h>
#include <sys/wait.h>
void handler(**int** signo){
printf("SIGQUIT:%i Received\n", signo);
}
int main (**void**) {
signal (SIGQUIT, handler);
puts("Parent start");
if (fork() == 0)
   execl ("./Child", 0);
   wait(0);
   sleep (1);
   puts("Parent end");
   return 0;
}
	#include <stdio.h>
	#include <unistd.h>
	#include <signal.h>
	void handler(**int** signo){
	printf("SIGQUIT:%i
	Received\n",
	     signo);
	exit(2);
	}
	int main (**void**) {
	signal (SIGQUIT, handler);
	sleep (60);
	return 0;
	}	