KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2021
Department of Computer Science and Engineering
CSE 3201
Operating Systems

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Discuss the differences between internal and external fragmentation. How an operating system manages the dynamic storage-allocation problem? Explain using an example. (12)
   b) Discuss paging and the role of page table. Explain the paging organization while considering a suitable memory size along with a compatible page size. (12)
   c) Using a diagram explain how a page Table can be implemented. Briefly discuss the segmentation architecture. (11)

2. a) What are the differences among deadlock avoidance, detection and prevention? Using various 'Resource-allocation graphs' show a system is in a deadlock or not. (12)
   b) Using your own data explain Banker's algorithm. Besides, write the steps of Safety Algorithm. (12)
   c) Explain the purposes of 'wait for graph'. How it works? How resource preemption eliminates deadlock? (11)

3. a) How network-operating systems are different from distributed operating systems? Explain various migration happening over distributed operating systems. (12)
   b) Discuss the basic issues must be addressed while designing a communication network. How contention/conflicting demands are handled? Explain. (12)
   c) How a failure is detected in distributed environment? How access matrix can be implemented? (11)

4. a) Define distributed file system. Also explain its structure. (08)
   b) Define and differentiate between stateful and stateless service. (08)
   c) Discuss the categories of security violations. What is masquerading attack? (09)
   d) How RSA digital signature ensures genuine user authentication over insecure communication medium. Explain the technique using your own data. (10)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Describe the architecture of an operating system. (10)
   b) Define system call. Explain with necessary example the relationship of "API-System Call-OS". (15)
   c) What are the benefits of process scheduling? Explain with necessary diagram. (10)

6. a) What is process? Draw the state diagram of possible states of a process. (12)
   b) Define context switch. What are the factors that should be followed during process termination? Explain with example. (08)
   c) Define Inter Process Communication (IPC). How the synchronized communication link is established in message passing IPC model? Describe with examples. (15)

7. a) Do you think it's possible to execute processes concurrently on multi-core system? Clarify your statement. (10)
   b) Classify multithreading model. Which type is impossible to implement and why explain with example? (14)
   c) State the approaches of Thread cancellation. (06)
   d) What is system boot? Explain with example. (05)

8. a) Consider the following processes: (20)

Process	Arrival Time	Burst Time
P_1	1	8
P_2	1	4
P_3	2	9
P_4	3	5

Multilevel feedback queue is maintained for these processes. There exist three queues as like:

Q_0 – Round Robin with quantum $q = 4$ ms.

Q_1 – Round Robin with quantum $q = 8$ ms.

Q_2 – First Come First Serve.

Note: A process in Q_1 will preempt any process from Q_2 but will be executed only if Q_0 is empty.

Now, determine (i) Gantt Chart, (ii) Average waiting time, (iii) Turnaround time of all process execution.

b) Explain the steps handling a page fault with necessary diagram. (08)

c) What is semaphore? Explain the Producer-Consumer problem with necessary programs. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2021
Department of Computer Science and Engineering
CSE 3207
Applied Statistics and Queuing Theory

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Necessary table/graphs/charts (if any): z table, t table, χ^2-table, Table of F-statistics for $\alpha = 0{\cdot}05$

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define inferential statistics. How do probability and statistical inference work together? (10)
   b) CSE association of a university organized a competition for graduating students to select the best final year thesis where, each student's thesis was evaluated by three judges (departmental head of CSE, president of CSE association and dean of EEE faculty). Consider 10 students who participated in this competition and got the following marks where each student was given a score ranging from 0 to 10 by each judge. (20)

Head (Dept. of CSE)	1	6	5	10	3	2	4	9	7	8
President (CSE association)	3	5	8	4	7	10	2	1	6	9
Dean (EEE faculty)	6	4	9	8	1	2	3	10	5	7

   Use rank correlation coefficient to decide which pair of judges have the nearest approach to evaluate the students' thesis and interpret the result.
   c) Differentiate between parametric and non-parametric tests. (05)

2. a) When computing sample variance, why do we divide $\sum_{i=1}^{n}(x_i - \bar{x})^2$ by $(n-1)$ instead of n (sample size) to get an unbiased estimation of the population variance? Explain in detail. (12)
   b) The frequency distribution of battery lives is approximated by a normal distribution with mean $\mu = 3{\cdot}5$ and standard deviation $\sigma = 0{\cdot}7$. The expected frequencies are obtained by computing the areas under the hypothesized normal curve that fall between the various class boundaries. Decide whether or not the normal distribution provide a good fit for the distribution of battery lives using Chi-square test. (15)

Class Boundaries	1·45-1·95	1·95-2·45	2·45-2·95	2·95-3·45	3·45-3·95	3·95-4·45	4·45-4·95
Observed Frequency	2	1	4	15	10	5	3

   c) 'When we do not know the population standard deviation, different sample of the same size produces the same standard error'–justify the statement. (08)

3. a) Using the following data, where A, B, C and D represent four independent groups, perform a one-way analysis of variance using $\alpha = 0{\cdot}05$ and interpret the obtained result. (18)

Observation	A	B	C	D
1	8	12	18	13
2	10	11	12	9
3	12	9	16	12
4	8	14	6	16
5	7	4	8	15

   b) Derive the confidence interval for $\mu_1 - \mu_2$ using the means and variances of independent random samples of size n_1 and n_2 respectively, from approximately normal populations with unknown and unequal variances where μ_1 and μ_2 are the means of the above-mentioned populations. (12)
   c) Explain maximum likelihood estimator. (05)

4. a) The following are the findings of individuals who had their systolic blood pressure measured before and after receiving some treatment. Determine whether this treatment is effective in decreasing systolic blood pressure using a one-sided t test for the single mean and interpret the result. (Note: do not use paired t test) (16)

subject	1	2	3	4	5	6	7	8	9	10	11
before	135	142	137	122	147	151	131	117	154	143	133
after	127	145	131	125	132	147	119	125	132	139	122

b) Find correlation coefficient from the following two regression equations:

$$X + 2Y - 5 = 0, \quad 2X + 3Y - 8 = 0$$

c) Define type I and type II error. What are the important properties of a test of hypothesis? (0[redacted]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Before the distribution of certain statistical software, every fourth compact disk (CD) is tested for accuracy. The testing process consists of running four independent programs and checking the results. The failure rates for the four testing programs are, respectively 0·01, 0·03, 0·02, 0·01. (08)
   i) What is the probability that a CD was tested and failed any test?
   ii) Given that a CD was tested, what is the probability that it failed program 2 or 3?

   b) A producer of certain type of electronic components ships to suppliers in lots of twenty. Suppose that 60% of all such lots contain no defective components, 30% contain one defective component, 10% contain two defective components. A lot is picked, two components from the lot are randomly selected and tested, and neither is defective. What is the probability that two defective components exist in the lot? (07)

   c) A coin is tossed twice. Let z denote the number of heads on the first toss and w the total number of heads on the 2 tosses. If the coin is unbalanced and a head has a 40% chance of occurring, find (10)
   i) The join probability distribution of w and z.
   ii) The marginal distribution of w and z.

   d) If the probability that a fluorescent light has a useful life of at least 800 hours is 0·9, find the probabilities that among 20 such lights (10)
   i) at least 15 will have a useful life of at least 800 hours.
   ii) at least 2 will not have a useful life of at least 800 hours.

6. a) A fast-food restaurant has one drive-in window. Cars arrive according to a Poisson distribution at the rate of 2 cars every 5 minutes. The space in front of the window can accommodate at most 10 cars, including the one being served. Others car can wait outside this space if necessary. The service time per customers is exponential, with a mean of 1.5 minutes. Determine the following: (15)
   i) The probability that a customer must wait to get the service.
   ii) The expected waiting until a customer reaches the window to place an order.
   iii) The probability that the waiting line will exceed the 10-sapce capacity.

   b) An engineering professor purchases a new computer every two years with preference for three models: M1, M2 and M3. If the present model is M1, the next computer may be M2 with probability 0·2 or M3 with probability 0·15. If the present model is M2, the probabilities of switching to M1 and M3 are 0·6 and 0·25, respectively. And, if the present model is M3, then the probabilities of switching to M1 and M2 are 0·5 and 0·1, respectively. (14)
   i) Determine the probability that the professor will purchase the current model in four years.
   ii) Determine the steady-state probability distribution of this problem.

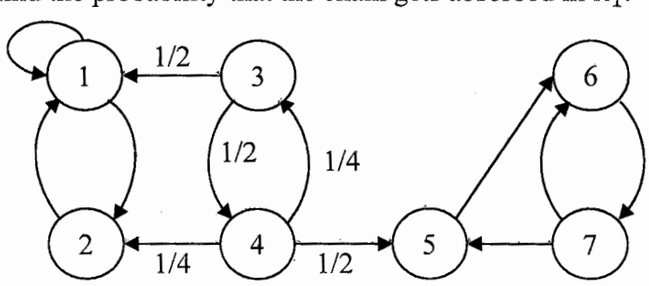
   c) Classify the states of the following Markov chains. If a state is periodic, determine its period. (06)

$$\text{(i)} \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}, \qquad \text{(ii)} \begin{pmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} & 0 \\ 0 & 0 & 1 & 0 \\ \frac{1}{3} & 0 & \frac{1}{3} & \frac{1}{3} \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

7. a) Derive the equation to compute mean response time of an $M/M/1/GD/n/\infty$ queuing system for various traffic intensities. The symbols have their usual meanings. (14)

   b) A small post office has two open windows. Customers arrive according to a Poisson distribution at the rate of 1 every 3 minutes. However, only 80% of them seek service at the windows. The service time per customer is exponential, with a mean of 5 minutes. All arriving customers form one line and access available windows on an FCFS basis. (11)
   i) Would it be possible to offer reasonable service with only one window? Explain.
   ii) Probability of waiting more than 3 minutes in queue.

   c) Consider the following Markov chain. There are two recurrent classes, $R_1 = \{1, 2\}$ and $R_2 = \{5, 6, 7\}$. Assuming $X_0 = 3$, find the probability that the chain gets absorbed in R_1. (10)

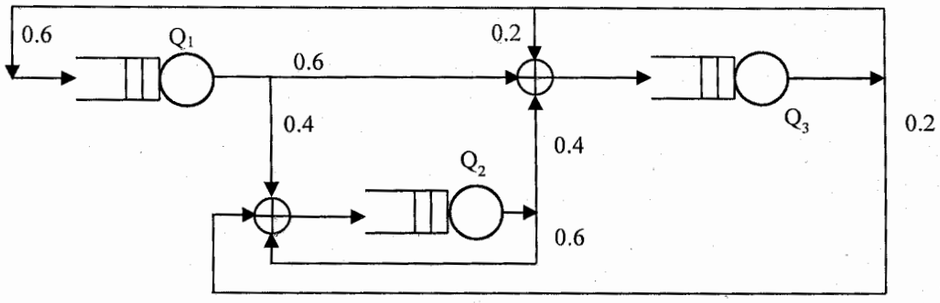


5. a) Optica, Ltd., makes prescription glasses according to orders received from customers. Each worker is specialized in certain types of glasses. The company has been experiencing unusual delays in the processing of bifocal and trifocal prescriptions. The worker in charge receives 30 orders per 8-hour day. The time to complete a prescription is normally distributed, with mean of 12 minutes and standard deviation of 3 minutes. After spending between 2 and 4 minutes, uniformly distributed, to inspect the glasses, the worker can start on a new prescription. Determine the following: (12)

i) The percentage of time the worker is idle.
ii) The average backlog of bifocal and trifocal prescriptions in Optica.
iii) The average time until a prescription is filled.

b) Consider the closed queuing network of single server queues with exponentially distributed service times, as shown in the following figure. The average service rates of Q_1, Q_2 and Q_3 are respectively $\mu_1 = 0{\cdot}5$, $\mu_2 = 1$ and $\mu_3 = 0{\cdot}5$. The system has a total user population of 4. Using the convolution approach, obtain the followings: (23)

i) The normalization constant.
ii) The state probability distribution of the network.
iii) The actual throughput of each queue.
iv) The average waiting time of each queue.



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2021
Department of Computer Science and Engineering
CSE 3211
Compiler Design

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Explain with a diagram how the statement a := b+c*10 is compiled. (10)
   b) Write a program in flex to detect the date-time format: "2019-09-07T15:50+00Z". (09)
   c) What are the differences between token and lexeme? Divide the following program segment into appropriate lexeme. (06)

```
int f1(n){
 float x;
 return (x<=-5.0||x>=5.0)?25:x*x;}
```

   d) Define activation tree. How do you implement activation tree? Draw the activation tree for the following pseudo code. (10)

```
main(){
    f1(e1);
    if f2(u2){
         f3(e1,u1);
         f4(e2);
          }
    else {
        f5(C1);
        f6(e2, u2);
          }
}
```

2. a) Define ambiguity of a grammar. Why do we eliminate ambiguity? Show that the following grammar is ambiguous. How can we select the unique parse tree from the grammar? (10)

$$S \rightarrow \text{if E then S} \mid \text{if E then S else S} \mid OS$$

   b) Define left recursion of a grammar. How can you eliminate left recursion? Eliminate left recursion from the following grammar. (09)

$$S \rightarrow Aa \mid b$$
$$A \rightarrow Ac \mid Sd \mid e$$

   c) What can be the contents of the stack for LL(1) parser? What are the actions taken by the parser if top of stack is a non-terminal X? (07)
   d) What is the significance of computing FIRST(α)? Compute the FIRST set from the following grammar. (09)

$$E \rightarrow TE'$$
$$E' \rightarrow +TE' \mid \varepsilon$$
$$T \rightarrow FT'$$
$$T' \rightarrow *FT' \mid \varepsilon$$
$$F \rightarrow (E) \mid id$$

3. a) "A grammar which is not left factored can not be LL(1) grammar" – Justify the statement. (06)
   b) Consider the following grammar (20)

$$S \rightarrow TL$$
$$T \rightarrow \text{int} \mid \text{real}$$
$$L \rightarrow L, \text{id} \mid \text{id}$$

   (i) Parse the input string "real id, id" using shift reduce parser. Show the handles that you replace.
   (ii) Construct the canonical LR(0) items and hence construct the SLR parsing table ACTION and GOTO.
   (iii) Draw the DFA for GOTO function.
   c) What is panic mode error recovery? How can you design a synchronization token for error recovery? (09)

4. a) Define intermediate code. How can you represent intermediate code? Represent the following code by quadruples and triples. (08)

$$a = b*c+a*c$$

   b) A 3 dimensional array is declared using the following c statement (Assume base value = 400) (10)

int A[10][15][20];

Develop the three address code to access an element e = A[i][j][k];

c) Write a program in bison to check the type of any declared variable.
INPUT: int a; show(a);
OUTPUT: int

d) Draw the flow of the control statements: (i) If E the S1 else S2, and (ii) while E do S1 (07)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Consider the grammar: (20)

$L \rightarrow E\ ;$
$E \rightarrow TE'$
$E' \rightarrow +TE_1'$
$E' \rightarrow \varepsilon$
$T \rightarrow FT'$
$T' \rightarrow *FT_1'$
$T' \rightarrow \varepsilon$
$F \rightarrow digit$

(i) Construct a syntax-directed definition (SDD) that performs arithmetic operations and shows output. (ii) Draw annotated parse tree and directed acyclic graph for input "14+6*2;".

b) How can you search for the lexeme of an identifier from symbol table? (07)

c) Test whether each of the following rules are L-attribute or S-attribute or none? (08)

$S \rightarrow AB$ {A.val = S.val and B.val = S.val}
$R \rightarrow PQ$ {R.val = P.val*Q.val and P.val = Q.val}

6. a) Write translation scheme to check the types of each statement of the following code: (15)

```
while(a<b) do
    if (c<d)
    then x = y+z
    else x = y-z
```

b) Construct the abstract syntax tree and then DAG for the statements: (10)
(i) $((x+y)-((x+y+z)*(x-y))+((x+y)*(x-y+z)))$, (ii) a+a+(a+a+a+(a+a+a+a))

c) How can you decide which function is to be overloaded using type checking? Show with examples and semantic rules. (10)

7. a) Consider the following code segment. (15)

```
/* code s */        /* code p */        /* code q */
  y = *q                                   x = b-c
  q = q+4             return               y = a+x
  call p                                   return
  call p
  halt
```

The code of these procedures start at addresses 100, 200, 300 respectively. The size of activation record for s, p, q are 66, 44 & 100 bytes respectively. The activation record of s is stacked initially at 600. Show the stack allocation when target code is produced.

b) Define Type system. When do you need dynamic checking? (08)

c) Suppose a particular machine requires register-pairs for integer multiplication and division. Generate the optimal machines code sequence for the expression: a+b+c/d. (07)

d) What is code motion? When do you need code motion? (05)

8. a) Explain the following loop optimization techniques with example: (i) Common subexpression elimination, and (ii) Loop Unwinding. (08)

b) What are the addressing modes supported by a target machine? Determine the cost the of the following instruction sequences: (09)

```
LD  R0,C          LD  R0,y
LD  R1,i          LD  R1,z
MUL R1,R1,8       ADD R0,R1,R0
ST  a(R1),R0      ST  x,R0
```

c) Consider the following three-address code: (18)

```
1.  n = 5                9.  t7 = t6*2          17. K = K*1
2.  if K>=n goto(20)     10. t8 = a[t7]         18. t10 = n*k
3.  t1 = n*i             11. t9 = t8*t7         19. K = K+1
4.  t2 = t1+j            12. goto(13)           20. t11 = t10+j
5.  t3 = t2*2            13. j = j+1            21. t12 = t11* 2
6.  t4 = c[t3]           14. i = i+1            22. t13 = b[t12]
7.  t5 = n*i             15. x = t9             23. y = t13
8.  t6 = t5+j            16. If i<n goto(3)     24. If K<n goto(17)
```

(i) Partition the code in basic blocks and show its control flow, and (ii) Optimize the code. Show the changes in code after you apply any optimization techniques.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2021
Department of Computer Science and Engineering
CSE 3217
Mobile Computing

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is mobile computing? What are current challenges of mobile computing and how can you cope with those challenges? (13)
   b) Draw the architecture of main Printed Circuit Board (PCB). (07)
   c) Briefly explain the components of Application Processor and Baseband Processor. (15)

2. a) What are ARM processors? Explain the seven operating modes of ARM processor. (10)
   b) What is Dalvik VM? Briefly explain the Native Libraries and Application Libraries of the Android architecture. (12)
   c) Draw the IOS architectural layers and explain the functions of each layer. (13)

3. a) What is Mobile-cloud computing? Explain Mobile-cloud computing structure clearly. (10)
   b) Why x86 architecture-based processors are inefficient for mobile computing? (10)
   c) Draw the architecture of a Context-aware System. (05)
   d) Explain the monitor-based augmented reality system. (10)

4. a) Write short notes of the following terms. (12)
   (i) MCP, (ii) eMMC, (iii) CMOS, and (iv) GSM.
   b) Explain Barrel Shifter, CPSR and SPSR of ARM processors. (10)
   c) What is Intent? Write the differences between client apps and web apps. (07)
   d) What is "Fat Finger" and "Mobile Widgets"? Explain briefly. (06)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What is Ubiquitous Computing? What are the goals of pervasive computing? (10)
   b) Discuss briefly about the enablers of pervasive computing. (14)
   c) What is NGN? Draw and explain the architecture of NGN. (11)

6. a) What is ZDO? Explain briefly IEEE802.15.4 network topologies. (08)
   b) Define super frame. Explain various MAC layer frame formats defined by IEEE802.15.4. (12)
   c) Define zigbee stack. Briefly describe the layers of the zigbee stack. (10)
   d) In a converged media environment, how would you provide protection to user right? (05)

7. a) Discuss about the different types of CSMA version with appropriate figure. (13)
   b) Briefly describe how does MACA solve hidden terminal problem and exposed terminal problem? (12)
   c) Briefly discuss the structure of GPS. (10)

8. a) Define Random backoff timer. Briefly describe different type of waiting time of IEEE802.11. (10)
   b) Define contention window size. Write down the difference between B-MAC and X-MAC. (10)
   c) How does S-MAC choose and maintain schedule? (08)
   d) Explain reservation process in ATMA protocol. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2021
Department of Computer Science and Engineering
HUM 3227
Professional Ethics and Moral Thoughts

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) "Ethics is the science of good" – Explain it from your own perspectives. (10)
   b) What are the differences between morality and ethics? Discuss with example. (10)
   c) Narrate the core ethical values of engineering. (15)

2. a) Why should study engineering ethics? (10)
   b) What are the professional codes of ethics? Explain it with example. (15)
   c) Discuss about the senses of engineering ethics. (10)

3. a) Are all moral values relative? Explain it from three different ideas. (10)
   b) What are the advantages of ethical relativism? (10)
   c) Is man purely intellectual? Does he have both feelings and intelligence? – Explain with example. (15)

4. a) How is character formed? Explain briefly – desire, self and character. (10)
   b) What are the forms of ethical egoism? Discuss it with example. (10)
   c) Where does intuition come from? How does ethics relate to intuitionism? (15)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Explain ethics as a moral philosophy. (10)
   b) Do you think Moral Good is that which satisfies our moral will? (10)
   c) Bring out the relationship between moral situation and moral decision. (15)

6. a) What is organizational commitment and what are the components of it? (10)
   b) Explain motivation in the light of Need-based theory. (10)
   c) Explain Hofstede's "Four-value dimension framework" of societal value system and relate it to moral values. (15)

7. a) Bring out the moral theory and thinking of Aristotle. (15)
   b) Describe family and its moral functions. (10)
   c) Describe Kohlberg's theory of moral development. (10)

8. a) What do you mean by "self"? How is it related to our socialization and moral development? (13)
   b) What is moral development? Explain psychological aspect of moral development. (12)
   c) Explain morality in international context. (10)