KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2017
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) Define and discuss the characteristics of deadlock. Using several 'Resource-allocation graphs' depict scenarios of deadlock and no-deadlock. (12)
   b) Explain pre-condition and data structures for Banker's Algorithm. Also using your own data, explain Banker's algorithm. (13)
   c) How you decide, a system is in safe state? Explain the purpose of 'wait for graph'. Also construct it from 'Resource-Allocation graph'. (10)

2. a) Define distributed operating system (OS). Explain how remote resources are accessed herein. (12)
   b) Discuss the most common routing strategies in distributed communication with possible merits and demerits. (10)
   c) Explain the most common connection strategies in distributed communication. (08)
   d) How a failure is detected in distributed environment? Explain. (05)

3. a) In memory, how logical address space is defined? Using necessary diagram, explain how instruction and data are combined to memory address. (12)
   b) Define paging. Depict the paging model of logical and physical memory. Give an example of it for a 32 byte memory with 4 byte pages. (11)
   c) How TLB facilities to implement paging hardware? Depict with a diagram. Why segmentation and paging are combined sometimes into one scheme? (12)

4. a) What is meant by 'masquerading' attack? Discuss various types of program threats. (10)
   b) Depict how a boot-sector computer virus affects an OS. (08)
   c) How digital signature can ensure user authentication? Explain. (07)
   d) Using your own data show how RSA cryptosystem ensures secure communication over insecure medium. (10)

SECTION B

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

5. a) What are the essential managers of Operating System? Briefly describe. (10)
   b) How operating System boots up? (05)
   c) Write down the services provided by Operating System. (10)
   d) Define system call. Discuss the Layered Structure of Operating System. (10)

6. a) What is starvation problem? How can it be solved? (07)
   b) An Operating System uses Shortest Remaining Time First (SRTF) process scheduling algorithm. Consider the arrival times and burst times for the following processes: (16)

Process	Burst Time	Arrival Time
P_1	20	1
P_2	25	15
P_3	10	30
P_4	15	65

   Calculate the waiting time and turnaround time for each process.
   c) What is race condition? Mutual Exclusion can be acquired by Producer Consumer Problem Concept. Explain it with semaphore. (12)

7. a) Draw the process state diagram. (06)
   b) What is Context Switching? Discuss about process control block. (13)
   c) "Pthread is a specification, not implementation." Justify the statement. (06)
   d) What do you mean by implicit threading? Describe it with Grand Central Dispatch method. (10)

8. a) Define Virtual Memory. Write down the advantages of partial loading. (07)
   b) Describe the steps of handling page fault with necessary figure. (12)
   c) Let's memory access time = 200 nanoseconds, average page fault service time = 8 microseconds. If page fault rate is 0.2%, determine the 'Effective Access Time'. (06)
   d) Compare the performance between Optimal Page Replacement and Least Recent Used algorithm for the page reference string: 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2; where, RAM size = 3. (10)

c) What is multilevel feedback queue? Explain multilevel feedback queue with the following scenario: (13)

Level 1 queue Q1: RR scheduling with 2 milliseconds of time quantum.
Level 2 queue Q2: RR scheduling with 4 milliseconds of time quantum.
Level 3 queue Q3: RR scheduling with 8 milliseconds of time quantum.
Level 4 queue Q4: SJF scheduling.

Suppose, 4 processes arrive at nearly same time and they arrive sequentially. Their names and burst time are as follows:

Processes	Burst Time
A	3
B	8
C	15
D	3

7. a) Define the following terms: (09)
   i) Soft real time systems.
   ii) Hard real time systems.
   iii) Exponential averaging.
   b) State the four conditions to hold for a good solution with mutual exclusion. (05)
   c) What is semaphore? Solve the producer-consumer problem with semaphore. (15)
   d) In Dining Philosopher problem, what will happen if all the five philosophers take their left fork simultaneously? (06)

8. a) What are the drawbacks of linked list allocation scheme of file? How can these be solved by FAT? Explain with simple example. (10)
   b) What is i-node? What are the benefits of i-nodes over FAT? (05)
   c) What is demand paging? Suppose, memory access time = 200 nanoseconds, average page-fault service time = 8 milliseconds and there is one page fault in every 4,00000 memory access. Find out Effective Access Time. (12)
   d) Apply LRU page replacement algorithm to the following reference string: (08)
   7 7 0 0 1 2 3 7 1 2 4 6 5 1 1 2
   There are 3 page frames. Show the number of page faults.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2017
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.

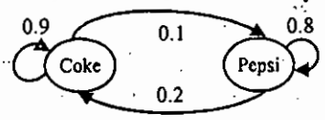
Section A

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

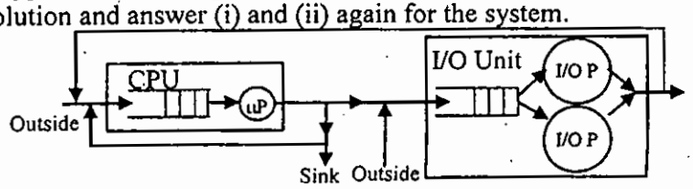
1. a) Define discrete and continuous sample space. (05)
   b) The probability that a medical diagnostic test correctly identifies someone with the illness as positive is 0.99, and the probability that the test correctly identifies someone without illness as negative is 0.95. The incidence of illness in the general population is 0.001. You take the test, and the result is positive. What is the probability that you have the illness? (12)
   c) In a company 1000 applicants show up for 70 new job positions. The company takes a test to select the best candidates. The mean marks on this test turns out to be 60, with a standard deviation of 6. Can a person who scores 84 count on getting one of the jobs? Assume that the marks distribution is symmetric about the mean. (10)
   d) Computer technology has produced an environment in which robots operate with the use of microprocessors. The probability that a robot fails during any 6-hour shift is 0.10. What is the probability that a robot will operate through at most 5 shifts before it fails? (08)

2. a) Consider a Poisson random variable X with parameter λ. Show that the variance of X is λ. (09)
   b) The life, in years, of certain type of CPU cooling fan has an exponential distribution with an average life = 3. If 100 of such fans are installed in different laptops, what is the probability that at most 30 fail during the first year? (09)
   c) A computer is shared by 2 users who send tasks to a computer remotely and work independently. At any minute, any connected user may disconnect with probability 0.5, and any disconnected user may connect with a new task with probability 0.2. Let X_t be the number of concurrent users at time t, which is a Markov chain with 3 states: 0, 1, and 2. (17)
      i. Compute state transition probabilities and draw the transition diagram of the Markov chain.
      ii. Determine the steady-state distribution of the chain.

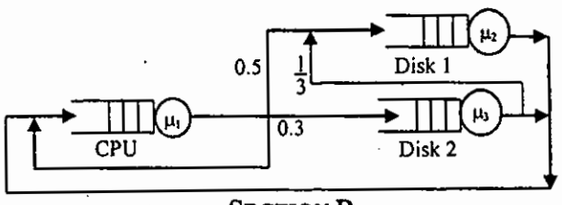
3. a) Define stochastic process. What are the conditions for a stochastic process to be a Markov chain? (07)
   b) Prove that the n-step transition probabilities of a Markov chain with state transition matrix P can be represented by P^n. (08)
   c) Briefly discuss about the Kendall-Lee notation for Queuing systems. (10)
   d) According to the following figure, given that a person is currently a 'Coke' purchaser, what is the probability that he will purchase 'Pepsi' three purchases from now? (10)



4. a) Consider the following queuing network consisting of a CPU and an I/O unit having a single microprocessor and two I/O processors for those units respectively. On average process arrives from outside to CPU and I/O unit are 10 and 6 per minute respectively. On average it takes 1.25 second to serve a process by the microprocessor, whereas for an I/O processor average service time is 4 second per process. Finishing the CPU service, half of the process goes next to I/O unit, $\frac{1}{10}$ th goes back to CPU, and the rest leaves the system. All processes immediately return to CPU after completing I/O service. Consider each of the unit has an infinite capacity queue, and the inter-arrival and service times are exponentially distributed. (20)
      i. What factors of time the system will be idle?
      ii. Find the average response time of the system.
      iii. What will happen if the average service time of an I/O processor increases to 5 second? Propose a solution and answer (i) and (ii) again for the system.



   b) Consider a simple file server system shown in the following figure that consists of a CPU, and two disks (disk1, disk2). Labels of the arrows in the figure shows the routing probabilities of jobs. There are always four jobs in the system. The mean time to complete the CPU operation for a job is 0.05 second. The mean time to complete disk1 and disk2 operation is 0.125 and 0.2 second respectively. What is the probability that the CPU is busy? (15)



SECTION B

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

5. a) Formally define random sample and population. (05)
   b) State Central limit theorem. Travelling between two campuses of a university via bus takes, on average, 28 minutes with a standard deviation of 5 minutes. In a given week, a bus transported passengers 40 times. What is the probability that the average transport time was more than 30 minutes? Assume the mean time is measured to the nearest minute. (13)
   c) Consider the following measurements of the heat producing capacity of the coal produced by two mines (in millions of calories per ton): (10)

Mine 1:	8260	8130	8350	8070	8340	
Mine 2:	7950	7890	7900	8140	7920	7840

   Can it be concluded that the two population variances are equal?
   d) Define Type I and Type II error. What are the important properties of a test of hypothesis? (07)

6. a) The computer keyboards of manufacturer A have a mean lifetime of 6.5 years and a standard deviation of 0.9 year, while those of manufacturer B have a mean lifetime of 6 years and a standard deviation of 0.8 year. What is the probability that a random sample of 36 keyboards from manufacturer A will have a mean lifetime that is at least 1 year more than the mean lifetime of a sample of 49 keyboards of manufacturer B? (10)
   b) A mobile battery manufacturing company claims that their batteries will last an average of 30 hours. To maintain this average, 16 batteries are tested each month. If the computed t-values falls between $-t_{0.025}$ and $t_{0.025}$, the company is satisfied with its claim. What conclusion should the company draw from a sample that has a mean $\bar{x} = 27.5$ hours and a standard deviation $s = 5$ hours? Assume the distribution of battery lives to be approximately normal. (10)
   c) Market researchers know that background music can influence the mood and purchasing behavior of customers. A study was conducted in restaurants where the customers heard: no music, French music and Italian music. Under each condition, the researchers recorded the number of French, Italian or other food dishes were ordered. The following table summarizes the data: (15)

Food	None	French	Italian	Total
French	30	39	30	99
Italian	11	1	19	31
Other	43	35	35	113
Total	84	75	84	143

   Test if the type of music being played has a significant effect on food dishes sales.

7. a) What is maximum likelihood estimator? Explain likelihood function with a proper example. (07)
   b) Derive the maximum likelihood estimator of a Poisson parameter. (12)
   c) Estimate the difference in means of two normal populations. (12)
   d) Define Bayes estimator. (04)

8. a) Define simple linear regression and multiple regression. (02)
   b) What do you understand by SSR, SSE and SST? How R^2 explains the fit of the regression model? (06)
   c) A study was made on the amount of converted sugar (y) in a certain process of various temperatures (x). the data were recorded in the following table: (17)

Temperature, x	Converted Sugar, y
1.0	8.1
1.1	7.8
1.2	8.5
1.3	9.8
1.4	9.5
1.5	8.9
1.6	8.6
1.7	10.2
1.8	9.3
1.9	9.2
2.0	10.5

      i. Estimate the linear regression line.
      ii. For temperature 1.75, determine the sugar level.
   d) Explain the relationship between the coefficient of determination and the sample correlation coefficient. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2017
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) What are the phases of a compiler? Translate the following statement into different phases. (14)
position = position + initial + rate * 60;
b) Divide the following program segment into appropriate lexemes (08)

```
float LimitedSquare(x){
float x;
return (x<=-10.0 || x>=10.0)?100: x*x;
```

c) Define activation tree and control stack with examples. What are the contents of a general activation record? (13)

2. a) Write a program in flex to detect an unsigned number. (07)
b) What is dangling else problem? Explain with example. (10)
c) Define left recursion of a grammar. Eliminate left recursion from the following grammar (08)
S→Aa | b
A→Ac | Sd | f
d) 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 nonterminal X? (10)

3. a) What should the parser do in an error case? Explain the panic mode error recovery in LL(1) parsing. (09)
b) Explain the general configuration of LR parsing algorithm with its actions. (11)
c) What is canonical LR(0) items? Find the canonical LR(0) items from the following grammar (15)
$E' \rightarrow E$
E→E+T
E→T
T→T*F
T→F
F→(E)
F→id

4. a) Define intermediate code. What are the types of intermediate representation? Represent the following statement into syntax tree and hence propose a data structure to implement it (10)
a = b * -c + a * -c
b) Consider the following code segment (10)

```
i = 2 * n + k;
while i do i = i – k;
```

i) Generate the three address code. ii) Implement the code using quadruples.
c) How can you translate the switch-case statement? Write the translation scheme for the following code segment (10)

```
switch(ch){
        case 1: c = a + b; break;
        case 2: c = a - b; break;
          }
```

d) How can you reuse the temporary names? (05)

SECTION B

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

5. a) Define lookahead symbol. What are the properties of a parse tree? (06)
b) Explain the following terms with proper example: (09)
i) Associativity of operators. ii) Precedence of operators.
c) Define predictive parsing. Consider the following grammar: (13)
expr→expr+term|expr-term|term
term→term*factor | term/factor |factor
factor→digit | (expr)
Write down the pseudo-code for the predictive parser that validates an input string which follows the syntax of the above grammar.

d) Construct Directed Acyclic Graph (DAG) for the following statement: (6)

$$a + a * (b - c) + (b - c) * d + a * (b - c)$$

6. a) "In a syntax tree, chains of single productions may be collapsed"-Justify the statement with proper example. (06)

b) Consider an arithmetic expression (represented in infix notation) consists of operators '+' and '-'. The operands are number and identifier. (10)

i) Write down the syntax-directed definition for constructing a syntax tree for the above expression.

ii) Construct a syntax tree for the input a-4+c.

c) Define type system. When do you need dynamic checking? (09)

d) Suppose a language consists of declarations followed by statements. the statements are assignment, conditional and while statements. Type of declarations are int and char. Write down the translation scheme for checking the type of statements and declaration of identifiers. (10)

7. a) Define flow graph with suitable example. (06)

b) Suppose a particular machine requires register-pairs (an even and next odd numbered register) for integer multiplication and division. The even register contains the value of the operand (operand denotes multiplicand/dividend). The instruction has the following format: (08)

OP Source, Destination

Now consider the following three-address code:

```
t:=a+b
t:=t*c
t:=t/d
```

Generate optimal machine-code sequences for the above three-address code.

c) Calculate the cost of the following instructions: (09)

i)
```
MOV B, R0
ADD C, R0
MOV R0, A
```

ii)
```
MOV B, A
ADD C, A
```

iii)
```
MOV *R1, *R0
ADD *R2, *R0
```

d) Consider the following code segment: (12)

```
/* code for s */
action1
call q
action2
halt

/* code for p */
action3
return

/* code for q */
action4
call p
action5
return
```

The code for these procedures starts at addresses 100, 200 and 300 respectively. The stack starts at 600 and each action instruction takes 15 bytes. Show the stack allocation when the target code is produced.

8. a) Explain code motion with example. (05)

b) Explain following peephole optimization with proper example: (08)

i) Redundant-instruction elimination.

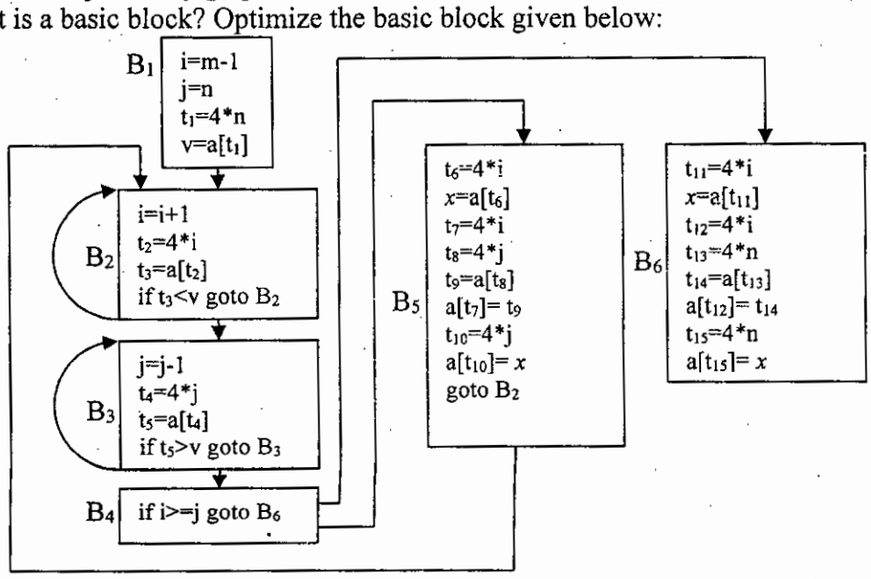
ii) Flow-of-control optimization.

c) Given the following code segment: (07)

```
A=x*x+2*x*y+y*y
B=x*x-2*x*y+y*y
```

Draw the dependency graph before and after common sub-expression elimination.

d) What is a basic block? Optimize the basic block given below: (15)



Your optimization must be included followings: (i) Common Sub-expression elimination, (ii) Copy propagation, (iii) Dead code elimination, and (iv) Reduction in strength.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2017
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? List the many other names which are compatible with mobile computing. (07)
   b) "A close relationship of mobile apps and wireless communication is the fundamental to mobile computing"-Justify the statement. (08)
   c) What are the current challenges of mobile computing? Explain how to cope with these challenges. (10)
   d) Explain the mobile computing architectural layers clearly. (10)

2. a) What do you mean by UI and UX design for a mobile device? Explain the guidelines for designing good UIs. (10)
   b) What is usability? Explain the mobile usability app design principles. (10)
   c) What is Context-aware computing? Why do you need it in mobile computing? Explain it using example(s). (10)
   d) Draw the architecture of Context-awareness system. (05)

3. a) What are the basic functions of Smartphone Operating System? Classify different Smartphone operating systems. (07)
   b) "Smartphone operating system is critical resources managers"-Justify the statement. (06)
   c) What is Android? Draw the Android OS architectural layers and explain the functions of each layer. (10)
   d) Compare the iOS architecture with Android architecture. (05)
   e) Discuss the iOS security features clearly. (07)

4. a) Why do you use the baseband processors in mobile phones? Explain the typical baseband processor structure clearly. (10)
   b) What are ARM processors? Classify different ARM processors and explain the general register sets of it. (13)
   c) "To augment your everyday experiences by superimposing a layer of visual indicators directly onto your field of vision"-Explain this Google glass project aim using an example. (12)

SECTION B

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

5. a) What are the design considerations for wireless MAC protocol? (07)
   b) Write down the difference between CSMA/CD and CSMA/CA protocol. (10)
   c) Discuss about the different types of CSMA version with appropriate figure. (12)
   d) Define polling and reservation method for wireless sensor network. (06)

6. a) Define wireless sensor network. Write down some characteristics of wireless sensor network. (07)
   b) Why need wireless MAC protocols? Why CSMA/CD protocol fail in wireless communications? (09)
   c) Briefly describe how MACA solve hidden terminal problem and exposed terminal problem? (11)
   d) What is meant by "unfairness" in WSN? How MACAW solve unfairness of a wireless network? (08)

7. a) Briefly describe how IEEE 802.11 MAC protocol works for WSN? (07)
   b) Write down the difference between B-MAC and X-MAC protocol with appropriate figure. (10)
   c) Define Geolocation and GPS. Briefly discuss the structure of GPS. (12)
   d) Write down some applications of wireless Sensor Network. (06)

8. a) Write down the difference between TMAC and SMAC. How does S-MAC choose and maintains schedules? (13)
   b) Define Random backoff timer. Briefly describe different types of waiting time of IEEE 802.11. (10)
   c) What are the different types of common protocol for WSN? Write down the difference between 1-persistent CSMA and p-persistent CSMA. (12)