

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 3<sup>rd</sup> Year 2<sup>nd</sup> Term Examination, 2018  
 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 distributed system. Discuss merits of it. (08)  
 b) Discuss the most common routing schemes in distributed communication with possible merits and demerits. (09)  
 c) Explain the most common connection strategies in distributed communication. (09)  
 d) Explain the techniques to avoid repeated collisions over a communication network. (09)
2. a) Define deadlock. Using several 'Resource-allocation-graphs' depict scenarios of deadlock. Also explain conditions of deadlock. (15)  
 b) Discuss preconditions and data structures of Banker's algorithm. Also explain it using your own data. (13)  
 c) Discuss the issues of resource preemption to eliminate deadlock. (07)
3. a) What is distributed file system? Discuss about its structure. (08)  
 b) Define access matrix. How it can be implemented? (08)  
 c) 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)  
 d) Depict how a boot-sector computer virus affects an operating system. (08)
4. a) What is 'man-in-the-middle' attack? Discuss various types of program threats. (10)  
 b) How TLB facilitates to implement paging hardware? Depict with a diagram. Why segmentation and paging are combined sometimes into one scheme? (12)  
 c) Define the following storage allocation algorithms: (07)  
     (i) First fit, (ii) Best fit, and (iii) Worst fit.  
 d) How digital signature can ensure user authentication? Explain. (06)

SECTION B

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

5. a) What do you mean by real time operating system? Classify it with examples. (10)  
 b) How does CPU switch from one process to another? Show with necessary diagram. (10)  
 c) What is Zombie process and Orphan process? (05)  
 d) Classify the parameters of Pthread\_create() and Pthread\_join() functions. (10)
6. a) Write down the system call sequences to copy the contents of one file to another file. (12)  
 b) Define critical region. Mutual exclusion can be acquired by Producer Consumer Problem concept. Explain it with Semaphore. (15)  
 c) Explain Busy Waiting in strict allocation method to achieve mutual exclusion. (08)
7. a) Discuss about the CPU scheduling criteria. (05)  
 b) An operating system uses Multilevel Queue process scheduling algorithm. Consider the following table of four processes under Multilevel Queue Scheduling. Queue Number denotes the queue of the process. Priority of queue1 is greater than queue2. Queue uses Round Robin (Time Quantum = 3) and queue2 uses FCFS scheduling algorithm. (15)

Process	Arrival Time	Burst Time	Queue Number
P <sub>1</sub>	2	5	1
P <sub>2</sub>	0	6	2
P <sub>3</sub>	4	3	1
P <sub>4</sub>	10	7	1

Calculate the waiting times and turnaround times for each process.

- c) What is the problem occur in Priority-based CPU scheduling? How does it can be solved? (08)

- d) Write down the difference between preemptive and non-preemptive CPU scheduling (07) algorithm.
8. a) Define demand paging. Suppose, the performance of demand paging is degraded by 20%. (12)  
Then what was the page fault rate? Assume, Memory Access Time = 150 nanoseconds, average Page Fault Service Time = 8 microseconds.
- b) Determine the number of page fault using Least Recently Used (LRU) page replacement (13) algorithm for the following reference string. Assume, RAM size is 4.  
Reference String: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1.
- c) Explain Belady's anomaly in FIFO page replacement algorithm with graphical view. (10)

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 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) z-table/t-table/ $\chi^2$ -table/Poisson & binomial probability sum/areas under normal curves/critical values will be provided if necessary.

**SECTION A**

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

1. a) State Baye's rule of probability. Consider a new computer program consists of two modules. (12)  
 The first module contains an error with probability 0.2. The second module has a probability of 0.35 to contain an error, independent of the first module. An error in the first, second module alone causes the program to crash with probability 0.5 and 0.7 respectively. The program crashes with probability 0.85 when there are errors in both modules. Suppose the program crashed, what is the probability of errors in both modules?
- b) Show that exponential random variable with parameter  $\lambda$  has a variance  $\frac{1}{\lambda^2}$ . (07)
- c) Installation of sum software package requires downloading 82 files. On the average it takes 15 (08)  
 sec. to download one file, with a variance of 16 sec<sup>2</sup>. What is the probability that the software is installed in less than 20 minutes?
- d) A small computer lab has 3 terminals. The no. of students working in the lab is recorded at the (08)  
 end of every hour. The lab attendant notices the following pattern:  
 If nobody in the lab, then the no. of student in 1 hour increases by 1 is twice as likely as to remain unchanged. If there are 1 or 2 students in the lab, then there is an equal chance to increase by 1, decrease by 1, or remain unchanged.  
 If all the terminals are busy, then the no. of students in 1 hour has 50-50% chance to decrease by 1 or remain unchanged.
  - i) Write the transition probability matrix for this Markov chain.
  - ii) Suppose there is nobody in the lab at 8am. What is the probability that somebody is working in the lab is 11am?
2. a) A dangerous computer virus attacks a folder consisting of 250 files. Files are affected by the (08)  
 virus independently of one another. Each file is affected with probability 0.032. What is the probability that more than 10 files are affected by the virus?
- b) Consider two stocks. Stock 1 always sells for \$10 or \$20. If stock 1 is selling for \$10 today, (15)  
 there is an 80% chance that it will sell for \$10 tomorrow. In case of \$20 selling, there is a 90% chance that the price will stay same tomorrow. Stock 2 always sells for \$10, \$15, and \$25. The transition probability of stock 2 can be presented by the following matrix:

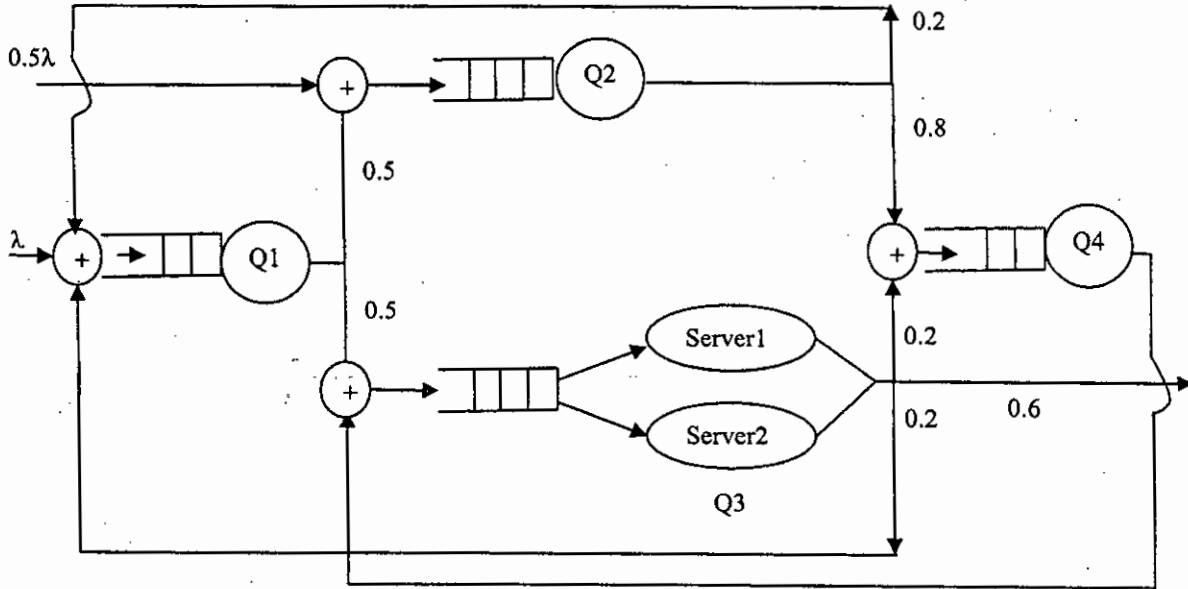
$$\begin{array}{c}
 \$10 \quad \$15 \quad \$25 \\
 \begin{array}{l}
 \$10 \left[ \begin{array}{ccc} 0.9 & 0.05 & 0.05 \\
 \$15 \left[ \begin{array}{ccc} 0.30 & 0.5 & 0.20 \\
 \$25 \left[ \begin{array}{ccc} 0.15 & 0 & 0.85 \end{array} \right]
 \end{array} \right.
 \end{array}
 \end{array}$$

On the average which stock will sell in higher price? Find and interpret all mean return times?

- c) State the flow balance equation of birth-death process. Also derive the steady state (12)  
 probabilities of birth-death process from the equation.
3. a) Derive the equation to compute mean response time of an M/M/1/GD/n/ $\infty$  queuing system for (13)  
 various traffic intensities. The symbols have their usual meanings.
- b) Consider an M/G/1 queuing system with mean customer arrival rate of 10/hour. Customers (08)  
 are serviced following an Erlang distribution with scale parameter 1 minute/customer and shape parameter 5.
  - i) What is the expected time a customer spend in the system?
  - ii) What it would be if customer were serviced with a deterministic distribution with same mean.

c) Consider the open queuing network of M/M/S type shown in the figure below.

(14)



The mean service rates are  $\mu_1 = \mu_3 = \mu$  and  $\mu_2 = \mu_4 = 0.5\mu$ . External arrivals are at  $Q_1$  and  $Q_2$  following Poisson process.

i) What will be the maximum value of  $\lambda$  for which the network will be stable?

Find the following for  $\lambda = 0.1$  and  $\mu = 1$ .

ii) The mean response time a customer will experience from the network.

iii) The mean no. of customer waiting in each queue.

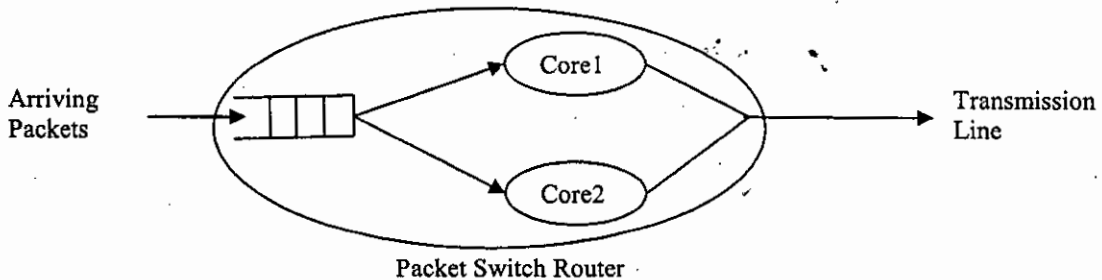
4. a) The following figure shows a dual core packet switch router with a fixed link capacity  $C = 1.544 \text{ Mb/s}$ . Packets are arriving with an arrival rate  $\lambda = 2000 \text{ packets/s}$  following Poisson process. We approximate the packet length by an exponential distribution with mean  $515 \text{ bit/packet}$ . Be noted that each core's routing capacity is 60% of the link capacity.

i) Expected time an arriving packet spent in the queue.

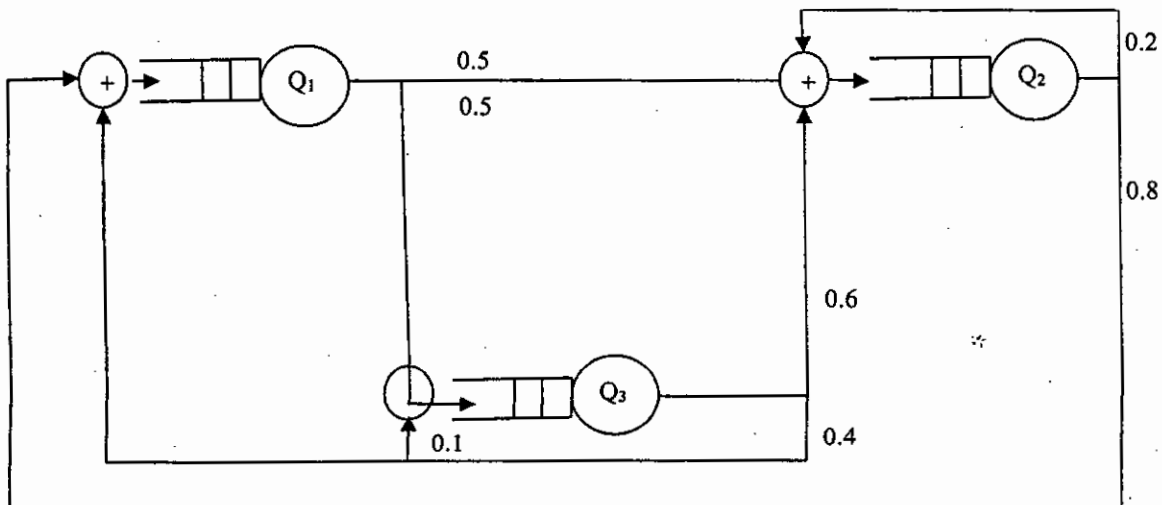
ii) Average number of packets in the router.

iii) Probability that an arriving packet will immediately be routed.

iv) Mean number of idle core.



b) Consider the closed queuing network of single server queues with exponentially distributed arrival and service times, as shown below.



The average service rates of  $Q_1$ ,  $Q_2$  and  $Q_3$  are respectively  $\mu_1 = 1$ ,  $\mu_2 = \mu_3 = 0.5$ . The system has a total user population of 4. Using the convolution approach, obtain the followings:

i) The normalization constant.

- ii) The state probability distribution for the network.
- iii) The actual throughput of each queue.
- iv) The average waiting time of each queue.

**SECTION B**

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

5. a) Define random sample and population. (05)
- b) The laptops of a manufacturer A have a mean life time of 6.5 years and a standard deviation of 0.9 year, while those of manufacturer B have a mean life time of 6 years and a standard deviation of 0.8 year. What is the probability that a random sample of 36 laptops from manufacturer A will have a mean life time that is at least 1 year more than the mean life time of a sample of 49 laptops from B? (12)
- c) Find  $K$  such that  $P(K < T < -1.761) = 0.045$  for a random sample of size 15 selected from a normal distribution and  $\frac{\bar{X} - \mu}{s/\sqrt{n}}$  (13)
- d) Mention the important properties of test hypothesis. (05)
6. a) Explain "Goodness of Fit Test" with proper example. (10)
- b) A vote is to be taken among the residents of a town and the surrounding country to determine whether a proposed chemical plant should be constructed. To determine if there is a significant difference in the proportion of town voters and the country voters favoring the proposal, a poll is taken. If 120 of 200 town voters favor the proposal and 240 of 500 country residents favor it, would you agree that proportion of town voters favoring the proposal is higher than the proportion of country voters? Use a  $\alpha = 0.05$  level of significance. (12)
- c) A college infirmary conducted an experiment to determine the degree of relief provided by three cough remedies. Each cough remedy was tried on 50 students and the following data received. (13)

Cough Remedy			
	NyQuil	Robitussin	Triaminic
No relief	11	13	9
Some relief	32	28	27
Total relief	7	9	14

Test the hypothesis that the three cough remedies are equally effective. Use a P-value in your conclusion and  $\alpha = 0.05$ , level of significance  $Z_{0.05} = 1.645$ .

7. a) Explain tolerance limits and prediction interval. (10)
- b) Ten engineering schools in some country were surveyed. The sample contained 250 electrical engineers, 80 being woman; 175 chemical engineers, 40 being woman. Compute a 90% confidence interval for the difference between the proportions of women in these two fields of engineering. Is there a significant difference between the two proportions? (12)
- c) An experiment reported in popular science compared fuel economics for two types of similarity equipped diesel mini-trucks. Let us suppose that 12 Volkswagen and 10 Toyota trucks are used in 90 km per hour steady-spaced tasks. If the 12 Volkswagen trucks average 16 km per liter with a standard deviation of 1 km per liter and 10 Toyota trucks average 11 km per liter with a standard deviation of 0.8 km per liter, construct a 90% confidence interval for difference between the average km per liter of these two mini trucks. (13)

8. a) The grades of a class of 9 students on a midterm report (x) and the final exam (y) are as shown follows: (13)

x	77	50	71	72	81	94	96	99	67
y	82	86	78	34	47	85	99	99	68

- i) Estimate the linear regression line.
- ii) Estimate the final grade of a student who secure 85 on midterm.

- b) If  $S^2$  is the variance of a random sample of size  $n$ . Show that  $S^2 = \frac{n \sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2}{n(n-1)}$  (09)

- c) Discuss 'One way analysis of variance' method to test the equality of mean values for more than two population. (13)



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B.Sc. Engineering 3<sup>rd</sup> Year 2<sup>nd</sup> Term Examination, 2018  
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 compiler? Translate the following statement into different phases (12)  
$$\text{position} = \text{value} + \text{rate} \times 75\%.$$
  
b) Write a program in flex to detect a floating point number of the form 426.52 and 46.2E+5. (08)  
c) Define activation tree and activation record. Explain with example. (07)  
d) "If a and b are procedure activations, then their lifetimes are either non-overlapping or nested"-justify the statement with example. (08)
2. a) What do you mean by ambiguity of grammar? Show that following grammar is ambiguous- (10)  
$$S \rightarrow \text{if } E \text{ then } S \mid$$
$$\text{if } E \text{ then } S \text{ else } S$$
  
b) Why do you need a grammar to be left factored? Apply the idea of left factoring with the following grammar (10)  
$$A \rightarrow abB \mid aB \mid cdg \mid cdeB \mid cdfB$$
  
c) Consider the following grammar. (15)  
$$S \rightarrow iCtSE \mid a$$
$$E \rightarrow eS \mid \epsilon$$
$$C \rightarrow b$$
  
(i) Find the FIRST and FOLLOW set, (ii) Construct the LL(1) parse table, and (iii) Do you think the above grammar is a LL(1) grammar? Explain your answer.
3. a) What is the general configuration of a LR parsing algorithm? Explain the actions of LR parser. (09)  
b) Consider the following grammar- (18)  
$$E \rightarrow E + T$$
$$T \rightarrow T * F$$
$$F \rightarrow \text{id}$$
  
(i) Define closure and goto operation with example, (ii) Find the canonical LR(0) items of the grammar, and (iii) Construct the SLR parsing table of the grammar.  
c) What is the handle for shift reduce parser? Consider the grammar, (08)  
$$E \rightarrow E + T \mid T$$
$$T \rightarrow T * F \mid F$$
$$F \rightarrow (E) \mid \text{id}$$
  
and the input is  $\text{id} + \text{id} * \text{id}$ . Find the handles for right sentential form.
4. a) Define intermediate code. Represent the following statements into intermediate code. (08)  
$$x[i] = y \text{ and } x = y[i]$$
  
b) Generate the semantic rule for while statement of the form  $S \rightarrow \text{while } E \text{ do } S_1$  and hence generate the three address code for the following code segment. (12)  
$$i = 2 * n + k;$$
$$\text{while } i \text{ do}$$
$$i = i - k;$$
  
c) Let A be a 3 dimensional array of size  $10 \times 20 \times 30$  where  $Low_1 = Low_2 = Low_3 = 0$  and  $base = 100$ . Develop the three address code for  $X = A[i][j][k]$ . (10)  
d) What is the address code of  $a \langle b$ ? (05)

**SECTION B**

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

5. a) Differentiate between one-pass and multi-pass compiler. (06)  
b) Consider an arithmetic expression (represented in infix notation) of integers and identifiers with the four binary operators +, -, \*, /. Now construct an unambiguous grammar to evaluate the expression. Also verify your grammar with an input string that contains all the operators (09)

mentioned above.

- c) Define predictive parsing. Consider the following grammar: (12)

type  $\rightarrow$  simple |  $\uparrow$  id | array[simple] of type

simple  $\rightarrow$  integer | char | num dotdot num

Write down the pseudo code for the predictive parser that validates an input string which follows the syntax of the above grammar.

- d) Explain the following terms with proper example. (08)

(i) Associativity of operators and (ii) Precedence of operators

6. a) Suppose we have the following declarations: (07)

```
typedef struct{
    int a, b;
    char c;
}CELL, *PCELL;
```

```
CELL foo[100];
```

```
PCELL bar(x,y) int x;
```

Write type expressions for the types of foo and bar.

- b) Define syntax directed translation. Consider the grammar (10)

string  $\rightarrow$  digit string operator | digit | string digit operator

digit  $\rightarrow$  0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

operator  $\rightarrow$  \* | / | + | -

(i) Construct a syntax directed translation scheme that translate arithmetic expressions from postfix notation to infix notation and (ii) Draw the annotated parse tree for the input "952\*-".

- c) "Uniformity and completeness of the instruction sets of the target machine are important for optimal code generation."-justify the statement with appropriate example. (08)

- d) Consider the following code segment: (10)

```
/*code for s*/      /* code for p*/      /* code for q*/
action 1            action 3            action 4
call q              return              call p
action 2            action 5            action 5
halt                return              return
```

The code for these procedures start at addresses 100, 200 and 300 respectively. The size of activation record for s, p and q are 64, 84 and 100 bytes respectively. The activation record of main procedure starts at address 500. Each action instruction takes 10 bytes. Show the static allocation when the target code is produced.

7. a) "The order in which computations are performed can negatively affect the efficiency of target code"-justify the statement. (10)

- b) Consider the following code segment: (25)

```
begin
    prod = 0
    begin
        prod := prod + A[i] * B[i] + C[i]
        i := i + 1
    end
    while i ≤ 50
end
```

(i) Produce three address code, (ii) Find the basic blocks and draw the flow graph, and (iii) Construct the DAG for the basic blocks.

8. a) Define type system. When do we need dynamic checking? (07)

- b) Given the following code segment (10)

```
x = a * a + 2 * a * b + b * b
y = a * a - 2 * a * b + b * b
z = x * x + y
```

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

- c) What is the role of register descriptor and address descriptor in code generation algorithm? (13)  
Show the generated code along with the contents of register descriptor and address descriptor for the following code segment for a simple machine model.

```
T = A - B
U = A - C
V = T + U
W = V + U
```

- d) Define code motion with example. (05)



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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) Define Mobile Computing. Explain the Mobile Computing architectural layers clearly. (12)  
b) "A smart phone acts as a bunch of sensors"-justify the statement. (08)  
c) What are the current challenges of Mobile Computing? Explain how to cope with these challenges. (10)  
d) List five other names which are compatible with Mobile Computing. (05)
2. a) "A close relationship of mobile apps and wireless communication is the fundamental to Mobile Computing"-justify the statement using an example. (12)  
b) Explain the anatomy of a general smart phone device vividly. (13)  
c) Explain mobility constraints of smart devices. (10)
3. a) What is augmented reality? Compare augmented reality and virtual reality. (10)  
b) Explain the monitor-based augmented reality systems. (10)  
c) Explain the processes for mobile application design of augmented reality. (10)  
d) Mention some uses of mobile based augmented systems. (05)
4. a) What do you mean by UI and UX design for a mobile device? Explain the guidelines for designing good UIs. (10)  
b) What do you mean by usability? Discuss the principles of usability app design process. (10)  
c) Define Context-aware Computing. Why do we need it in mobile computing? Explain it using an example. (10)  
d) Draw the architecture of a Context-aware System. (05)

**SECTION B**

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

5. a) Define technological convergence. Explain the concept of convergence with proper figure. (10)  
b) What is NGN? Draw the architecture of NGN and write a short note on NGN. (12)  
c) Discuss about the impact of convergence on markets. (08)  
d) "A mobile web app should be as simple as possible, but no simpler."-justify the statement. (05)
6. a) What is Ubiquitous Computing? What are the goals of pervasive computing? (10)  
b) Discuss briefly about the enablers of pervasive computing. (15)  
c) How WSN can be applied in military and health sector? Discuss briefly. (10)
7. a) Point out the differences between iOS and Android OS architecture. (10)  
b) Why iOS devices provide better optimization opportunity to the developers than android device? (10)  
c) "Resources are scarce in mobile platform."-justify the statement. (10)  
d) Discuss the iOS security features clearly. (05)
8. a) Define ARM architecture of processors. Explain the general register set of ARM processors. (15)  
b) Classify different CORTEX processors and point out their features. (10)  
c) Why x86 architecture based processors is inefficient for mobile computing? (10)

