BINDURA UNIVERSITY OF SCIENCE EDICATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF ENGINEERINGAND PHYSICS

Bachelor of Science Honours Degree in Electronic Engineering

EEN3206 – Computer Architecture and Operating Systems

Time Allowed: 3 Hours   Total Marks:100

Special Requirements: Scientific Calculator, rule, pen, pencil

<u>INSTRUCTIONS</u>

1. Answer any **FIVE (5) questions**
2. The question paper **contains SEVEN (7) questions**
2. Each question carries **20 marks**

1(a)Explain the following advantages of computer networking
   (i)Data sharing   [2]
   (b)Given 192.168.10.10 IP address
   (i) Write down the host IP address   [1]
   (ii) Write the default network address   [1]
   (iii)Write down the default Subnet Net Mask   [1]
(c)Explain the following types of network security
   (i) VPN   [2]
   (ii)Firewalls   [2]
(d)**Which two protocols at** layer 4 of the OSI layer   [2]
(e)Discuss the following network topologies
   (i)Ring Topology   [3]
   (ii)Mesh Topology   [3]
(f)Discuss the following network
   (i)VLAN   [3]

2(a)(i) A process of size 200 MB needs to be swapped into the hard disk. But there is no space in memory. A process of size 250 MB is lying idle in memory and therefore, it can be swapped out. How much swap time is required to swap-in and swap-out the processes if:

   • Average latency time of hard disk = 10 ms
   • Transfer rate of hard disk = 60 MB/s   [3]
(ii)Three processes P1, P2, and P3 of size 21900, 21950, and 21990 bytes, respectively, need space in the memory. If equal-sized partitions of 22000 bytes are allocated to P1, P2, and P3, will there be any fragmentation in this allocation? Show working.   [3]
(b) Discuss the following memory allocation techniques
   (i)First-fit allocation   [3]
   (ii)Best-fit allocation   [3]
   (iii)Worst-fit allocation   [3]
(c)When is noncontiguous preferable to contiguous memory allocation?   [2]
(d)Let us assume that the user process is of size 2048KB and on a standard hard disk where swapping will take place has a data transfer rate around 1 MB per second. Calculate the time taken for actual transfer of the 1000K process to or from memory.
                                                                          [3]
3(a)State the difference between a process and a program in terms of resources.
     Program does not compete for resources while a process compete for
     resources.   [1]
   (b)What are the three main purposes of an operating system?   [2]

   (c)(i)The value of effective access time in demand paging should be at a minimum for
       better performance." Justify the statement.   [2]
     (ii)Why is the demand paging method more popular than demand segmentation in
       implementing virtual memory?   [2]
   (d)Consider a reference string 2,1,3,4,1,5,3,2,1,4,5. Suppose there are three free frames in

memory initially. All frames are empty at the beginning. Calculate the total number of page faults and page replacements using FIFO. [9]
(e)When does a page fault occur? [2]

4(a)Discuss the following Single user operating systems
 (i) Single-User Single-Tasking operating system [2]
 (ii) Single-User Multi-Tasking operating system [2]
(b)State three features of single user operating systems [3]
(c)State three examples of single user operating systems [3]

(d)State four functions of single user operating systems. [4]
(e)What are the advantages of single user operating systems [4]
(f)Explore the following disadvantages of single user operating systems
 (i) Idle time is higher [1]
 (ii) Tasks take longer to complete [1]

5(a)(i)Why are multiprocessors useful? [2]
   (ii)How do the responsibilities of a multiprocessor operating system differ from those of a uniprocessor system? [2]
(b)Discuss the following three types of multi-processor architectures with the aid of diagrams.
(i) Uniform Memory Access Architecture [4]
(ii)Non-Uniform Memory Access Architecture [4]
(c) With the aid of a diagram explain the following multiprocessor organisations
 (i) Master-Slave multi-processor organization/configuration [4]
 (ii)Separate kernel organisation/configuration [4]

6(a)(i) What are the necessary conditions which should be present for deadlock to occur?[4]
 (b)Why is the occurrence of deadlocks unfavourable in a system? [3]
 (c) There are various ways to handle deadlock. Different operating systems follow different methods to deal with the problem of deadlock. Discuss the following commonly used methods.
 (i)Deadlock prevention [3]
 (ii)Deadlock avoidance [3]
 (iii)Deadlock detection [3]
 (d)A process has relocatable code of size of 900 K. The relocation register is loaded with 40020 K and the limit register contains the address 41000 K. If the processor generates a logical address 990, where will it be located in the physical memory? [4]

7(a)(i)Discuss the salient features of Von Neumann concept in computer design.[3]
 (b)Show with diagram the implementation of this concept in a real computer system which has been produced in those days. [5]
 (c)What are the limitations of Von Neumann concept (also known as *Von Neumann's bottleneck*)? [6]
 (e) Discuss how modern days computers have evolved since Von Neumann's implementation of the computer. [6]

The End