



## POLYTECHNIC OF NAMIBIA

School of Engineering and Information Technology

Department of Information Technology

Private Bag 13388, 13 Storch Street, Windhoek, NAMIBIA

Tel: ++264 (0)61 207 2110 Fax: ++264 (0)61 207 2051

Curriculum:	80DISA Information Systems Administration and 80DSEN - Software Engineering		
Subject Code:	OPS110S		
Subject:	Operating Systems 1A		
Date: June 2005 – 1 <sup>st</sup> Opportunity	Paper: 1	Theory	
Duration: 3 Hours	Marks:	100	

### First Examination Question Paper

Lecturer / First examiner: Mr. Zablon Mbero  
Moderator: Dr. Bernd Kiekebusch

This question paper consists of 7 pages (excluding the front page)

Student Name: \_\_\_\_\_  
Student Number: \_\_\_\_\_

#### Instructions

1. Please answer all questions. Part 1 and Part 2 on the question paper, Part 3 in the Booklet provided. Where the question is a True or False or Multiple choice, mark the correct answer directly on the question paper with a cross in the provided check box. 0.5 points will be deducted per wrongly answered question.
2. When answering questions you should be led by the allocation of marks. Do not give too few or too many facts in your answer.
3. There are no books, notes or any other additional aids allowed **EXCEPT Pocket Calculators**.

## **PART 1 Multiple Choice (14 Marks)**

*(Mark your choice with an "X" in the appropriate box. One full mark will be given for each correct answer, one half mark will be deducted for each incorrect answer.)*

- 1. What is true about fixed partitions?** [2]
  - the size of the partitions is fixed forever due to hardware design
  - partition sizes can be changed any time, but only by the System administrator
  - the job scheduler determines a fixed partition for a job as soon as it knows its characteristics
  - Causes internal fragmentation
  
- 2. What is memory de-allocation?** [2]
  - Removal of Memory from computer
  - Removal of Partition from memory
  - Release of used memory (for subsequent reuse)
  - Flagging faulty memory locations to prevent further use
  - Adding a block of memory locations to the free space list
  
- 3. Which tables must the O/S not use to keep track of memory utilization in Paged Memory allocation scheme?** [1]
  - Job Table (JT)                       Page Map Table (PMT)
  - Segment Map Table (SMT)        Memory Map Table
  
- 4. Which are types of operating systems?** [3]
  - operating systems                       Embedded systems
  - Interactive systems                       Batch systems
  - Priority Systems                           Hybrid systems
  
- 5. What mechanisms are used for process synchronization?** [3]
  - Wait & see                                   Interrupts
  - Semaphores (P&V)                       Wait & Signal
  - Test & dine                                   Test & set
  
- 6. Which multiprocessor configuration is called "Asymmetric"?** [1]
  - Loosely coupled                           Tightly coupled
  - Master/slave                                   Cluster
  
- 7. What is false for Virtual Memory?** [2]
  - programs cannot be executed in virtual memory
  - Virtual memory is a segment of main memory
  - virtual memory is accessed during swapping
  - virtual memory must be faster than main memory
  - requires memory to divide their programs into segments

**PART 2 Short Questions (17 Marks)**

*(Answer the questions with the appropriate word(s) or a few short sentences.)*

1. Briefly explain the characteristics of two page replacement policies, which you now?  
[2]
  
2. Give three examples where demand paging is used/applied and explain them? [3]
  
3. In Segmented memory allocation, the O/S must keep several lists to keep track of memory utilization. Briefly describe the contents of SMT and MMT. [4]
  
4. What are the major differences between deadlock and starvation? [2]
  
5. What is the difference between the following terms as used in CPU/IO burst cycle?  
[2]:
  - (a) I/O bound processes
  
  - (b) CPU bound processes
  
6. What four conditions must be present at the same time in order for a deadlock to occur? [4]

**PART 3 Discussion (69 marks)**

*(Use a separate answer sheet (book) for this section)*

**Question 1 (15 marks)**

**Page Swapping**

1.1 Your computer's main memory shall consist of 3 available page frames. Do a page trace analysis by applying the FIFO page removal algorithm and calculate the failure rate and the success rate for the following sequence of page requests.

Mark page interrupts with asterisks (\*): [7]

D A C A D A E C E B

PF1

PF2

PF3

1.2 Repeat the page trace analysis with the LRU algorithm. [8]  
Which results do the failure rate and success rate give now?

D A C A D A E C E B

PF1

PF2

PF3

**Question 2 (7 marks)**

**2. Paging: Address Resolution**

[7]

A program of 3670 Bytes is compiled into pages of 100 Bytes. How many pages will be generated and how much internal fragmentation is caused?

The pages are loaded into the main memory, e.g. page 14 into page frame 9, page 15 into page frame 6, and page 16 into page frame 4.

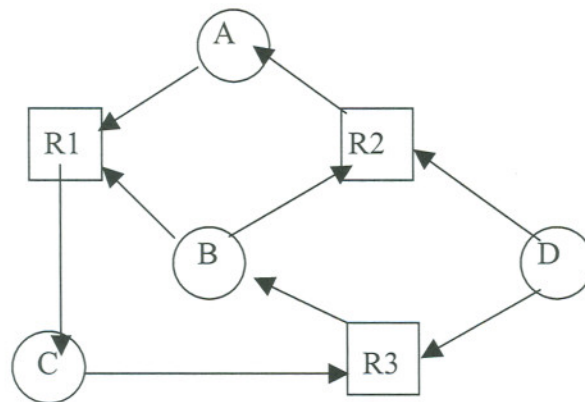
The processor wants to access the instruction at program address 1650. In which page will it find this instruction? What is the offset value?

Under which memory address can the CPU access this instruction, when the page size equals the page frame size?

**Question 3 (14 marks)**

**3. Detection of Deadlocks**

Consider the following resource demands as indicated in the directed graph:



3a. List all paths in this graph that indicate a deadlock(s). [4]

3b. Is there a starving process (which one)? Give a reason for your answer. [2]

3c. Determine, which process(es) can be cancelled individually (alone) to resolve all deadlock situations [2]

3d. Describe three methods to recover from deadlock. [6]

**Question 4 (15 marks)**

**Process Scheduling**

Consider the following Job Entry, apply different scheduling algorithms, draw their timelines and calculate the resulting: [6]

(a) Waiting Times (WT) and Average Waiting Times (AWT): [4.5]

(b) Turnaround Times (TAT) and Average Turnaround Times (ATAT): [4.5]

Arrival Time:	0	1	2	3	4	ms
Job:	A	B	C	D	E	
CPU-Cycles:	10	2	3	1	5	ms

---

WT FCFS:						ms	AWT:
TAT FCFS:						ms	ATAT:
WT SJN:						ms	AWT:
TAT SJN:						ms	ATAT:
WT SRT:						ms	AWT:
TAT SRT:						ms	ATAT:

---

FCFS: First come – First serve  
SRT: Shortest remaining time

SJN: Shortest Job next

**Question 5 (18 marks)**

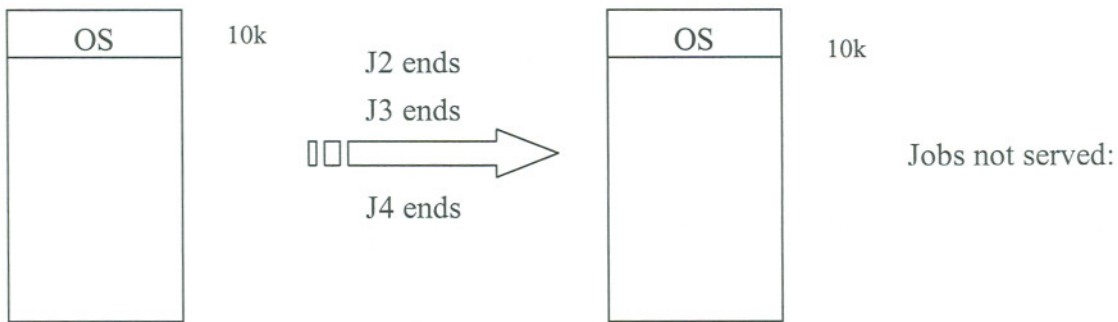
**Memory allocation scheme with Dynamic Partitions**

Consider the following job entry:

J1	25kB	J2	40kB	J3	15kB	J4	10kB
J5	50kB	J6	15kB	J7	40kB	J8	10kB

*Don't forget the memory space for the Operating System itself (10k)!*

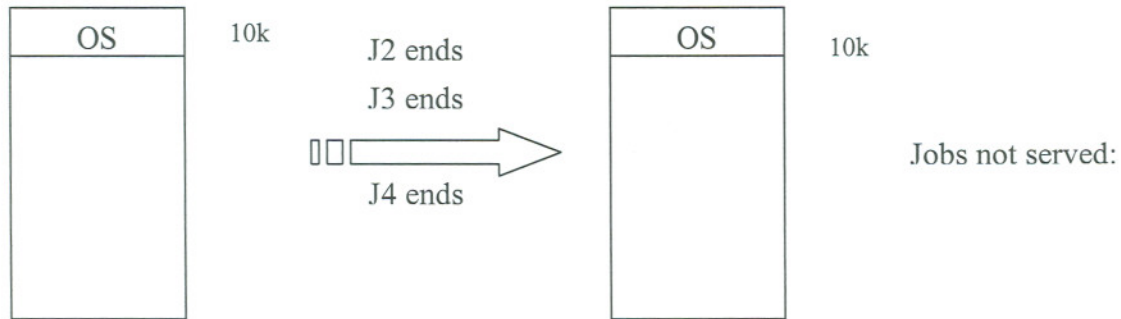
**5a.** Apply the **First-fit policy** and state how much memory is used and which jobs cannot be loaded: [5]



Max: 150k Used (jobs):

Max: 150k Used (jobs):

**5b.** Apply the **Best-fit policy** and state how much memory is used and which jobs cannot be loaded: [5]



Max: 150k Used (jobs):

Max: 150k Used(jobs):

**5c.** Comment on the results. Does one of the allocation policies have any performance advantage? [3]

**5d.** Set up a Free List and a Busy List for the final memory allocation after applying the best-fit policy (5b). [5]

**Free List (excluding O/S)**

Beginning address	Memory block size	Status
		F
		F
		F
		F

**Busy List (excluding O/S)**

Beginning address	Memory block size	Status
		B
		B
		B
		B
		B

**End of Exam**