S228/105C

DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8.

BSc. (Honours) Degree in Computer Science

Year 1

SEMESTER 2 EXAMINATIONS 2013/2014

CMPU 1022

Operating Systems 1

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Monday 19th May 2014 5.00 p.m. – 7.00 p.m.

Answer THREE Questions out of FOUR

Q1

(a.) Explain, with the aid of a diagram, the Von Neumann architectural model of a computer. (10 marks)

(b.) Describe the operation of an instruction cycle in a simple computer. (6 marks)

(c.) What is an assembler language and what are the advantages of using one in comparison to machine code? (6 marks)

(d.) The Little Man model of a computer system uses a single-digit op-code and 2-digit memory addressing and has the following instructions defined where the address portion is shown as xx

Op. Code	Description
1xx	Add value in memory to accumulator
2xx	Subtract value in memory from accumulator
3xx	Store accumulator value to memory
5xx	Load value in memory to accumulator
6xx	Branch to memory location
7xx	Branch on positive to memory location
8xx	Branch on negative to memory location
901	Input from In-tray to accumulator
902	Output to out-tray from accumulator
0xx	Halt

Write a program using the above machine code to read 2 numbers which are input to the in-basket, and display the difference between them as a positive number in the out-basket. Comment every instruction.

(12 marks)

Q2

(a.) An Operating System kernel can be described as having four major components (managers). Describe in a few sentences, each of these four components. (12 Marks)

(b.) With reference to process management:

(i.) Define *"lightweight process"*. (3 Marks)

(ii.) Define " *heavyweight process*". (3 Marks)

(iii.) Explain the differences between a lightweight and heavyweight process? (3 Marks)

(c.) Describe the states of the basic 5 State Process Model and how a computer system transitions between these states. Use a diagram to illustrate your answer. (10 Marks)

(d.) Name and describe the function of any two registers which one would expect to find in a typical CPU. (2 Marks)

Q3

(a.) Identify **and** explain the four conditions necessary for *Deadlock* to occur. (8 Marks)

(b.) Consider the following system snapshot using the data structures in the Bankers algorithm, four resources A, B, C and D used by processes P0 to P4.

	Allocation				Max				Need				Available			
													3	2	2	1
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P0	4	0	0	1	7	0	2	1								
P1	1	1	0	0	1	6	5	0								
P2	1	0	4	5	3	3	4	6								
P3	0	4	2	1	1	5	6	2								
P4	0	3	1	2	2	4	3	2								

Using Bankers algorithm answer the following:

(i.) How many resources of type A, B, C and D are there?
(ii.) What are the contents of the Need matrix?
(iii.) Is the system in a safe state? Provide reasoning for your answer.
(iv.) If a request from process P2 arrives for additional resources of {0, 2, 0, 0}, can the Bankers algorithm grant the request immediately? Provide reasoning for your answer. (12 Marks)

(c.) Identify **and** classify three methods of ensuring *mutual exclusion.* (9 Marks)

(d.) Consider the following statement with regard to Process Management:

"To ensure integrity of a shared resource or data, it is required that at most one process is executing in its ***Critical Region*** *at one time"*

Describe with the aid of a diagram how the access of two competing processes to a *Critical Region* is enforced. (4 Marks)

Q4

(a.) Describe the operation of a paged memory management system. Include in your answer the advantages and disadvantages of paged memory management over previous memory management systems. (9 Marks)

(b.) Using a diagram, explain the relationship between physical memory and logical memory address space.

(6 Marks)

(c.) Consider a demand paging system with three frames and the given page reference sequence.

Reference Sequence = [F, G, A, G, E, F, A, D, B, D, E, A, E].

How many page faults will occur with:

(i.)FIFO
(ii.)LRU
(iii.)OPT (also called MIN)

Show all of your workings. (12 Marks)

(d.) Explain the following terms used within memory management:

(iv.) Trashing (3 Marks)
(v.) Swap Space (3 Marks)