CS3BA31

UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering and Systems Sciences
Department of Computer Science

B.A (Mod.) Computer Science
Junior Sophister Examination

Trinity Term 2003

3BA3 - Systems Software

Friday 30th May | Sam.Beckett Room | 09.30 - 12.30

Dr. Ken Dawson-Howe

Attempt FIVE questions, at least TWO questions from each section.

Section A – Operating Systems

1. Explain what the following code does under UNIX. Ensure that you explain each system call and the concepts being used.

```
void process_things();
void syserr(char *msg);
void *test(void *parameters)
{
   int pfd[2];
   if (pipe(pfd) == -1)
      syserr("pipe");
   int new_pid = fork();
   if (new_pid < 0) {
      syserr("fork");
   }
   else if (new_pid == 0) {
      if ((close(pfd[0]) == -1) ||
          (close(STDOUT_FILENO) == -1) ||
          (dup(pfd[1]) == -1) || (close(pfd[1]) == -1))
         syserr("close and dup");
      execlp("/bin/ls","ls","-l",NULL);
   }
   else {
      if ((close(pfd[1]) == -1) ||
          (close(STDIN_FILENO) == -1) ||
          (dup(pfd[0]) == -1) || (close(pfd[0]) == -1))
         syserr("close and dup ");
   }
   pthread_exit(0);
}
main(int argc, char *argv[])
{
   pthread_t tid;
   pthread_create(&tid,NULL,test,NULL);
   pthread_join(tid,NULL);
   process_things();
}
```

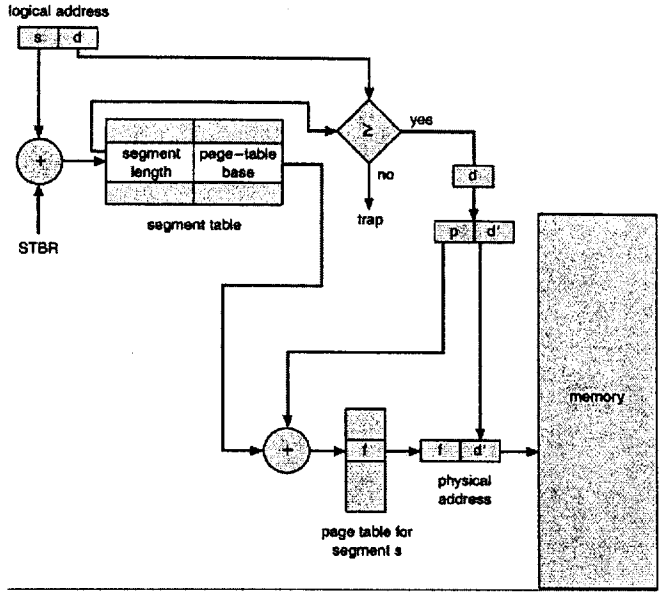
2. Equal marks are given for each part of this question

   a. "Windows NT uses demand paging with clustering together with a working set model for page allocation". Explain the concepts of (i) demand paging, (ii) clustering and (iii) the working set model.

   b. "Most operating systems make use of a round robin scheduling algorithm (within a priority scheduling system). However from an efficiency point of view it would be better to use Shortest Job First (with Exponential averaging)". Explain (i) round robin and priority based scheduling, (ii) shortest job first with exponential averaging, and (iii) discuss the validity of the statement.

   c. Determine Effective Access Time for the Multics operating system (as shown) given a memory access time of 80ns, an associative lookup time of 10ns with

a hit ratio of 98%, a page fault service time of 20ms with a page fault rate of 0.0000005



3. Part (a) counts for 40%, part (b) for 40% and part (c) for 20% of this question.

a. "SSTF and C-LOOK are reasonable choices as the default disk scheduling algorithm". Explain how these algorithms work (illustrating your explanations with sample disk head movements) and explain the situation in which each of the algorithms is particularly appropriate.

b. Explain the difference between deadlock prevention and deadlock avoidance. Include in your explanations examples of deadlock prevention and deadlock avoidance when faced with the following scenario (Ensure that you fully specify the algorithms you are using):

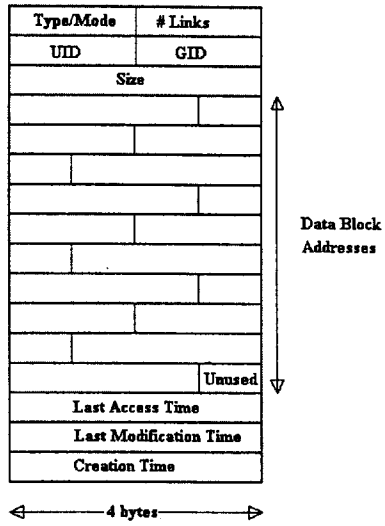
Current State:

	Allocation	Max
	A B C	A B C
P_0	3 1 1	4 3 1
P_1	0 0 1	3 0 1
P_2	1 1 1	2 1 1
P_3	0 1 0	1 3 1
P_4	0 1 0	0 3 0

Process 3 has requested an instance of resource A. Assume that there are 5 instances of resource type A, 6 of B and 3 of C in total

c. Explain the difference between (i) one-way encryption, (ii) symmetric encryption and (iii) asymmetric encryption. Include scenarios in which each of these techniques might be used.

4. Explain each of the fields in the following diagram of the UNIX i-node. Include a full explanation of (i) the disk allocation strategy used, (ii) the directory organisation used and (iii) the mechanism used to determine when files should be deleted.



Section B – Data Communications

5. Equal marks are given for each part of this question

   a. "Within 10 years optic fibre will completely replace the use of copper in networks". Discuss this statement and also fully describe (i) optic fibre and (ii) twisted pair.

   b. Compare and contrast CSMA/CD protocol with a collision free protocol based on contention slots for access to a shared medium by multiple stations. Ensure that you fully describe each protocol as part of your answer

   c. Given a set of valid codewords (000111, 111000, 101010, 010101) determine what the corrections should be made to the following corrupted codewords. Determine (theoretically) how much of an error can be corrected in general for this set of codewords.
      i. 000011
      ii. 010111
      iii. 111001
      iv. 111010

6. Part (a) counts for 50%, part (b) for 25% and part (c) for 25% of this question.

   a. "When communication is being made over a WAN the lower layers of the protocol stack are typically point-to-point within the communications subnet". Explain (i) the concept of a WAN including the communications subnet (ii) the OSI reference model protocol stack, and (iii) which layers of the OSI reference model are point-to-point and which layers are end-to-end, and what implications this has for error and flow control.

   b. Given a voice grade telephone line determine the number of signal levels and the signal to noise ratio (in dB) required in order to transmit 32Kbps.

   c. Explain what is meant if the data link layer of a network is described as being character oriented with character stuffing.

7. Part (a) counts for 50%, part (b) for 25% and part (c) for 25%.

   a. "Using a V.90 modem and the PSTN the maximum downstream data rate is 56kbps. ADSL will allow this to be increased to 8Mbps using the same line into the home". Explain in detail how both these data rates are achieved including details of the mechanisms involved.

   b. Explain bridges and detail how their routing tables are configured.

   c. Compare and contrast the use of low earth orbit satellites with the use of cellular radio for mobile telecommunications. Include details of how each technology works.

8. Equal marks are given for each part of this question.

   a. Explain how 802.11 wireless LANs control the sharing of the media.

   b. Explain fully the mechanisms used by HDLC both to accept and to reject frames received. Ensure that you include details of frame format where appropriate.

   c. Compare and contrast GSM and CDMA second generation mobile phone technology.