UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering and Systems Sciences
Department of Computer Science

B.A.(Mod.) Computer Science   Trinity Term 2004
Junior Sophister Examination

3BA3 - Systems Software

Thursday 20th May   Sam. Beckett Rooms   09:30 - 12:30

Dr Kenneth 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, and speculate on how "otherprog"
     and "process_things" might be related.

```
void process_things(MsgType* add);
void syserr(char *msg);
typedef struct {
    int type;
    bool read;
    char mess[200];
} MsgType;
main ()
{
    int id;
    MsgType* Add;
    if ((id = shmget((key_t) IPC_PRIVATE,
            sizeof(MsgType), 0666 | IPC_CREAT)) == -1)
        syserr("shmget");
    if ((Add = (MsgType*) shmat(SharedMemoryID, 0, 0)) ==
                        (void *)(-1))
        syserr("shmat");
    Add->read = TRUE;
    int new_pid = fork();
    if (new_pid < 0) {
        syserr("fork");
    }
    else if (new_pid == 0) {
        char param[20];
        sprintf(param,"%d",id);   // Formatted print to string.
        execlp("/user/me/otherprog","otherprog",param,NULL);
    }
    process_things(Add);
    if (shmctl(id,IPC_RMID,NULL) == -1)
        syserr("shmctl");
}
```

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

     "The Network File System (NFS) is stateless and is built on top of Remote
     Procedure Call (RPC) primitives. Generally it is accessed via the Virtual File
   System (VFS)".

     a. Explain in reasonable detail what NFS and VFS are and how they work.

     b. Compare and contrast RPCs with Sockets and with Basic Message Passing.
         Ensure that you include details of how these IPC mechanisms work.

     c. Explain what NFS being stateless means and how this affects the efficiency of
         file operations.

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

   a. "Solaris 2 uses a version of the second chance algorithm as its page replacement strategy". Explain the concepts of (i) page replacement, and (ii) the second chance algorithm.

   b. Determine if deadlock exists in the following situation. Ensure that you write down the algorithm used to test for deadlock, and also discuss what should be done if deadlock is discovered.

      Note that you should assume that there are a total of 5 resources of type A, 6 resources of type B and 3 resources of type C.

	Allocation			Request		
	A	B	C	A	B	C
P_1	1	3	0	1	0	1
P_2	0	0	1	0	1	1
P_3	2	0	0	1	0	0
P_4	2	2	0	0	2	1
P_5	0	1	2	0	0	0

   c. The Intel 80386 uses the architecture shown in the following diagram for page lookup. Determine the EAT given a memory access time of 100ns, an associative lookup time of 5ns with a hit ratio of 95%, a page fault service time of 10ms with a page fault rate of 0.000001
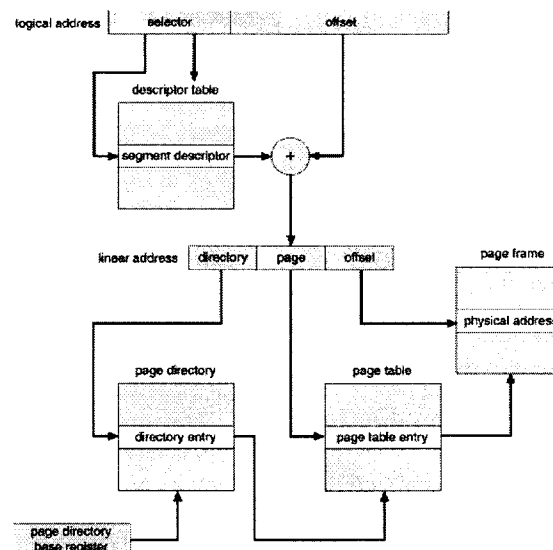
4.   Part (a) counts for 40%, part (b) for 40% and part (c) for 20% of this question.

    a. "For process/thread scheduling Windows NT uses priority scheduling with round robin scheduling within each priority". Explain in full process/thread scheduling as used in Windows NT. Ensure that you include in your description details of how starvation is avoided.

    b. Probably the most used security breach is the theft and subsequent misuse of passwords. Explain (i) five ways in which passwords could be stolen, (ii) five methods for protecting passwords and (iii) describe how passwords are stored.

    c. Compare and contrast 'polling' with 'interrupts' as methods of communicating with I/O devices. Include full explanations of each technique and how they are used for two way communication.

Section B – Data Communications

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

  a. "The TCP/IP model fits together very well with the Ethernet standard". Explain why this is so and provide details of (i) the TCP/IP model and (ii) the Ethernet standard.

  b. Explain the different levels of service which may be offered by the data link layer, including details of when each would be appropriate to use.

  c. Compare the different generations of Ethernet and explain how the speed increases have been achieved without altering the basic protocol or frame format.

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

  a. Explain how the HDLC protocol deals with traffic normally (including frame formats), how it detects and deals with errors (corrupted and missing frames), and how it deals with flow control.

  b. "Given a network which is heavily loaded it would be better to use a CSMA protocol or a limited contention protocol". Discuss this statement and include details of (i) a CSMA protocol and (ii) a limited contention protocol.

  c. Given a generator polynomial $(x^4 + x^3 + 1)$ compute the Cyclic Redundancy Check (CRC) value to be transmitted for this frame 1 0 0 1 0 1 1 0 1 1 0. Explain the algorithm you use to compute the CRC.

7. Part (a) counts for 60% and part (b) for 40% of this question.

  a. "At present there are 3 main competitors for providing high speed data rates to the home: ADSL, Cable (TV) Systems, and Broadband Wireless". Compare and contrast these three technologies including details of how each of them works.

  b. Explain how DCF and PCF work together to control access to the shared medium in an 802.11 (Wireless) LAN.

8.   Part (a) counts for 40% and part (b) for 60% of this question.

    a. "TDM has replaced FDM as the main mechanism for multiplexing telephone conversations onto trunk lines". Explain why this is so and detail both methods.

    b. Explain the protocol described by the Petri Net model which follows. Also, detail in a step-by-step manner (in terms of places, tokens and transitions)
        • the successful transmission of a frame
        • followed by the loss of a frame
        • followed by the loss of an acknowledgement
        • followed by a successful retransmission.