Question 1

a) Describe the Producer/Consumer problem.

(3 marks)

b) Describe the problems associated with producing a software solution to the producer/consumer problem.

(7 marks)

c) Show a possible solution to the above problem, stating any assumptions that you make.

(15 marks)

Question 2

a) Describe the four generations of computing and how operating systems developed as a result.

(12 marks)

b) There is some debate as to what will constitute a fifth generation computer. Assume such a computer is available. What do you think will differentiate it from the computers of today?
What advances do you think need to be made in order to produce a fifth generation computer?

(13 marks)

Question 3

a) Describe the following scheduling algorithms

- Non Pre-Emptive, First Come, First Serve
- Round Robin
- Shortest Job First

(9 marks)

b) Given the following processes and burst times

Process	Burst Time
P_1	10
P_2	6
P_3	23
P_4	9
P_5	31
P_6	3
P_7	19

Calculate the average wait time when each of the above scheduling algorithms is used?

Assume that a quantum of 8 is being used.

(12 marks)

c) Which scheduling algorithm, as an operating systems designer, would you implement?

(4 marks)

Question 4

a) Describe the benefits of a mono-programming operating system.

(5 marks)

b) A company, using a multi-programming operating system, has 1 megabyte of memory.

The operating system occupies 250K of memory and every process that is executed also requires 250K of memory.
The processes have an average I/O wait time of 80%.

The company ask you if they should invest in more memory and, if so, how much. What would you advise and why?

Would your advice change if the company said they had made a mistake and the average I/O wait time was only 20%? If so, why?

(20 marks)

Question 5

a) The buddy system is a memory management scheme that uses variable sized partitions.

Explain the basic principle behind the buddy system.

(5 marks)

b) Assume a computer with a memory size of 256K, initially empty. Requests are received for blocks of memory of 5K, 25K, 35K and 20K. Show how the buddy system would deal with each request, showing the memory layout at each stage and the status of the lists at the end.

After allocating all the processes, what would be the effect of the 25K process terminating and returning its memory?

(10 marks)

c) Describe and evaluate an alternative to the buddy system

(10 marks)

Question 6

a) Every file in a filing system has a set of attributes (read only, date created etc.). Assume a filing system allows an attribute of *temporary*, meaning the creating process only uses the file during the time it is executing and has no need for the data thereafter. Assume the process is written correctly, so that it deletes the file at the end of its execution. Do you see any reason for an operating system to have *temporary* file attribute? Give your reasons.

(5 marks)

b) An operating system supplies system calls to allow you to COPY, DELETE and RENAME a file.
Discuss the differences between using COPY/DELETE and RENAME to give a file new name?

(5 marks)

c) An operating system only allows a single directory hierarchy but allows arbitrary long filenames. Could you simulate something approximating a hierarchical file system? Give your reasons.

(5 marks)

d) When a file is removed, the blocks it occupies are simply placed back onto the free list. Can you see any problems with this? If so, how would you overcome them and what problems, if any, would now exist and how would you resolve these?

(5 marks)

e) When the UNIX filling system opens a file its i-node is copied into memory. It has been suggested, that with memory getting cheaper that if *n* processes open the same file then *n* copies of the I-node could be held in memory. Is this a good idea? Give your reasons.

(5 marks)