[3 marks] What is the result of performing the following logical operations on a bit pattern P with n bits:

- `XOR` with a bit pattern of n 1's
  the complimentary bit pattern of P
- `AND` with a bit pattern of n 1's
  the bit pattern P
- `OR` with a bit pattern of n 0's
  the same bit pattern P

[2 marks] Fill in the blanks in the following sentences.

- Machine language instructions can be categorised into three types:
  - Data transfer instructions,
  - Arithmetic/logic instructions and
  - control instructions.
- The mnemonic name of an example of such an instruction is HALT or JUMP

[2 marks] Fill in the blanks in the following sentences.

A typical machine language instruction is represented by 16 bits.

- The first four bits represent the operation code
- The last 12 bits represent the operands

[2/18] There are two options when choosing an instruction set for a computer. These are to have a *reduced instruction set computer* (RISC) or to have a *complex instruction set computer* (CISC).

An advantage of RISC is
it makes the CPU efficient and fast

An advantage of CISC is
it makes the CPU easier to program

[2/18] The control unit in the central processing unit of a computer has 2 special purpose registers. These are the *instruction register* and the *program counter*.

The information held in the instruction register is

the instruction currently being executed

The information held in the program counter is

the address of the next instruction to be executed

[3/18] The instruction set of a machine is as follows:

1	R	XY	:	Load register R with the contents of memory address XY.
2	R	XY	:	Load register R with the bit pattern XY.
3	R	XY	:	Store the contents of register R into memory address XY.
4	0	RS	:	Move the contents of register R to register S.
5	R	ST	:	Add (using two's complement) the contents of register S with the contents of register T and place the result in R.
6	R	ST	:	Add (using floating-point) the contents of register S with the contents of register T and place the result in R.
7	R	ST	:	OR the contents of register S with the contents of register T and place the result in R.
8	R	ST	:	AND the contents of register S with the contents of register T and place the result in R.
9	R	ST	:	XOR the contents of register S with the contents of register T and place the result in R.
A	R	0T	:	Rotate the contents of register R to the right X times.
B	R	XY	:	If the bit pattern in register R is equal to the bit pattern in register 0 then jump to the address location XY otherwise continue to execute the next instruction.
C	0	00	:	Halt.

Consider the following piece of code:

Memory Address	Instruction
A0	2003
A1	2105
A2	2201
A3	5002
A4	B1A6
A5	5002
A6	5002
A7	C000

Assume the code is executed starting at the memory address A0.

After the code has been executed:

The contents of register 0 is 06

The contents of register 1 is 05

The contents of register 2 is 01

[2 marks] Fill in the blanks in the following sentences.

- One advantage of time multiplexing is:

  processes may be completed more quickly

- One reason we need a Process Control Block is:

  to allow us to perform context switching

[2/15] In terms of operating systems, how does the Memory Management Unit, located within the central processing unit, increase the security of processes?

The MMU prevents one process from accessing or altering the memory of another process

[2/15] Located within the kernel of an operating system are software components that perform basic functions, the role of the *scheduler* is

to determine activities to be executed

and the role of the *dispatcher* is

to control the allocation of time to those activities