

Section A

Question 1

Provide a detailed answer to each of the following questions:

List the four subsystems comprising a machine based on the von Neumann model.

What does the concept “a stored program” mean?

What are the two important aspects of programming that must be understood when we consider the von Neumann model?

Why does it make sense that data and program instructions have the same format?

What is a computer program?

Describe in your own words what an algorithm is.

What is meant by the term “software engineering” as defined in the context of the textbook?

List the main functions of an operating system.

Compare the memory content of early computers with the memory content of a computer based on the von Neumann model.

According to the von Neumann model, can the hard disks of today be used as input or output devices? Explain.

Question 2

Convert the following numbers into decimals:

(a) $(10101.1)_2$

(b) $(1010011.01)_2$

(c) $(517)_8$

(d) $(710.01)_8$

(e) $(A9F)_{16}$

(f) $(B08.4)_{16}$

Question 3

Convert the following decimal numbers into binaries, octals and hexadecimals:

- (a) 613.625 (b) 120.25

Question 4

Why is 845,3 not an octal number?

Question 5

Do the following binary arithmetic:

- (a) $10111 + 1111$ (b) $110100 - 10011$

Question 6

What are the disadvantages of the sign-and-magnitude representation?

Question 7

Write down the following numbers in binary, normalised floating-point representation:

- (a) 78.43 (b) 1.39×10^2

Question 8

What is the result if a logical right-shift operation is applied to the bit pattern 11001111?

Question 9

Using an 8-bit allocation, use 2s complement arithmetic to determine $-15 + 12$.