Computer Fundamentals Examples Sheet

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History and Computer Components

Q1. Compare the use of mercury delay lines to the use of RAM for computer storage

Q2. Compare and contrast CPU registers, RAM, and hard discs.

Q3. With the aid of a diagram, describe the *fetch-execute cycle*.

Q4. Why do you think CPU manufacturers haven't all agreed on a single set of CPU instructions?

Q5. A computer designer proposes replacing the RAM in a computer with millions more registers to make the same level of storage. Comment on the advantages and disadvantages of this approach.

Q6. Today's computers feature 'standby' and 'hibernate' low power modes. The standby mode keeps the data and CPU state in RAM; the hibernate mode copies it to the hard disc. Explain why standby draws more power but resume is faster.

Q7. Modern machines have single-digit gigabytes of RAM. Whilst this is a lot, it's often not enough. One approach to extending the availably memory is to use the hard disc as "swap space". Here we free up RAM by pushing chunks of data to the hard disc, reading them back into RAM only when the CPU needs them. Comment on the advantages and disadvantages of this approach.

Data Representation and Operations

Q8. Convert the following decimal numbers to binary, octal, hexadecimal, and base-5: i) 10 ii) 567 iii) 111

Q9. How does the register size of a system affect the amount of memory a system can support? How much system memory can we use if we have 8, 32 or 64 bit registers?

Q10. An alternative technique for representing negative numbers is *one's complement*. Here we invert all of the bits of a number to find its negative. i.e. +2 is 0010, so -2 is 1101. Compare this representation with sign-magnitude and two's complement.

Q11. Show how to perform binary subtraction on positive integers. Does your algorithm work unmodified for any of sign-magnitude, one's complement and two's complement numbers?

Q12. Imagine a 4-bit computer (i.e. its registers are 4 bits wide). Show how it could compute the result of (47+17)

Low and High Level Computing

Q13. Explain what is meant by i) a compiler; ii) an interpreter.

Q14. Distinguish between the imperative and functional programming paradigms.

Q15. Imagine you have a pointer to the start of a string that is properly terminated. Describe algorithms to i) find the length of string; ii) test whether it is a palindrome (the same backwards as forward). You are not expected to write any code, only to describe the algorithm in words.

Platforms and Multitasking

Q16. Explain the purpose of an Operating System.

Q17. Microsoft Windows uses "quantum stretching", where the current, in-focus application gets a longer time slot on the CPU. Explain why.

Q18. Apple recently started using Intel processors that support x86 instructions. This means Apple machines can now run Microsoft Windows. However, off-the-shelf PC software (which is compiled for x86) does not run directly on a Mac that is using the Apple operating system compiled for the Intel processor. Why not?

Q19. Explain briefly how Sun's Java platform is so portable.