

Problem Statement Set I

Fundamentals of Fundamentals:

1. State the need of automation as discussed in a class.
2. What three properties an automotive device should have so that it can replace delegation of work to humans?
3. State the process of 'analysis' or 'analytic thinking process' in your own words.
4. Read the explanation of term 'analysis' given in Grady Booch's 'Object Oriented Analysis and Design with Applications' and write it down in your words.
5. State the difference between policy and mechanism as discussed in class.
6. Comment on software design principle, 'Policy should be separate from mechanism'. (You may refer sources on the web)
7. Read the explanation given on 'Policy should be separate from mechanism' in 'Linux Device Driver' book by Rubini and write it down in your words.
8. Explain the term 'Programmability'.
9. How to differentiate between non-programmable and programmable device?
10. Define terms: Programmability, programming, programmer.
11. Give examples of any five systems where you can observe policy and mechanism split. Explain the policy mechanism split in those systems.
12. Give any five examples of non-programmable devices and explain why they are non-programmable.
13. Explain in non-technical terms the term 'Central Processing Unit'. (with respect to class discussion)
14. Explain how 'Central Processing Unit' is a programmable device with respect to above definition.
15. What is state?
16. Give five examples of real-life artifacts which exhibit different states.
17. Give five examples of real-life objects which not only exhibit different states but also their state can be explicitly controlled externally.
18. State the attributed required by a device to call it as a memory (with respect to class discussion)
19. State the fundamental principle of counting (Maths Question)

20. If there are two cups and three spoons, then how many pairs of cup and spoon can be formed. [Maths Question]
21. If the first question can be responded in terms of [Yes/No] and the second question can also be responded in terms of [Yes/No] then in how many ways two questions can be responded? [Maths Question]
22. Explain the term bit. [w.r.t. class discussion]
23. Explain the term byte. Derive how many different states a byte can hold based on fundamental principle of counting.
24. Explain memory organization metrices byte, kilo byte, megabyte, giga byte, tera byte, peta byte.
25. How many bytes is 1Kib? How many bytes in 1Kb? How many bytes is 1kb? How many bytes is 1KB?
26. Explain organization of 'Random Access Memory' (RAM) from programmers' perspective (not electronics implementation perspective)
27. Define and explain the floor (or least integer) function. [Maths question]
28. Define and explain the ceiling (or greatest integer) function. [Maths question]
29. Calculate the floor of the following. [Maths question]
(1) 3.4 (2) 4.564 (3) 0.433 (4) 2 (5) 3.0 (6) 10.154
(7) -1.32 (8) -4.564 (9) -0.12 (10) -0.0 (11) 0.0 (12) 1.23
30. Calculate the ceiling of the following [Maths question]
(1) 1.5443 (2) 2.123 (3) Pi (4) -Pi (6) -4.432
(7) 2.321 (8) 0.322 (9) 0.0 (10) -0.0 (11) 1.23 (12) -43.32
31. Explain the different between the floor function and the ceiling function. When the truncate and floor functions yield the same answer? When the truncate and the ceiling function yield the same answer? [Maths question]
32. Define and explain log function. (Explain in elaborate fashion the meaning of log y to the base x where base is not zero and one) [Maths question]
33. Why base of logarithm cannot be zero? [Maths question]
34. Why base of the logarithm cannot be one? [Maths question]
35. What are total number of states can a memory block with n bits can exhibit? What is the range of the non-negative integers that can be stored in the memory block of n bits? [Maths question]
36. Explain the relationship between the number of bits a memory block has, the number of states it can exhibit and the non-negative numbers it can store? [Maths question]

37. How much minimum storage in terms of bits will be required to represent non-negative integer n in memory? [Maths question]
38. Calculate the log of following with respect to 10 and 2. In case of fractional answers, you must calculate the whole part manually on paper and for fractional part you should use calculator.
(1) 10 (2) 2 (3) 100 (4) 100000 (5) 1Million (6) 1Billion
(7) 256 (8) 65536 (9) 13564 (10) 40 (11) 150 (12) 268
39. How much minimum storage in terms of bytes will be required to represent non-negative integer n in memory? [Maths question]
40. Comment on following principle.
"To represent any real life object in computer memory, you must quantize it and therefore storing a real life object in computer's memory is really storing the numbers associated with it which are obtained through quantization process."
[Refer lecture for explanation of the term: 'Quantization Process']
41. Take any ten different colours of your choice and say you want to store any one of them computer's memory. Then show quantization process and therefore calculate the storage requirement for the same.
42. Let us say there are 100 different sweatshirts in a shop. And sweatshirt of mannequin is to be chosen daily by a computer. How will you represent 'Today's Sweatshirt' in computer's memory? Show quantization and memory requirement calculations.
43. Consider a high-profile cabinet meeting where the government of India has decided to have a unique number (an Aadhar card number or social security number in USA) to every citizen of India. Considering Indian population to be 1.4Billion, how will you represent 'Aadhar number' in computer's memory? Show quantization and memory requirement calculations.
44. In high profile McDonalds meeting a strategy is being planned to make combo packages available to customer. A combo meal involves 4 different types of fries, 10 different types of burger and 7 different types of smoothies. Calculate how many different combo meals can be prepared. And how will represent 'Combo meal' entity in computer's memory. Show quantization and memory requirement calculations.
45. Explain the concept of processor supported word sizes. And explain how storage allocation requirement answer is aligned with processor supported word sizes.
46. Explain how 'CPU' instructions are quantized in MSTC microprocessor.
47. State different CPU instruction categories. And name few instructions in each of the category.
48. State the difference between operator and operand.
49. State and explain three different types of operands in detail.
50. Explain in detail the instruction format of MSTC microprocessor.