**Computer Science Foundation Exam**

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**Task 1.** On GitHub

**Task 2.**

**A.** Converting 10443 into binary:

For binary the base is 2. This number should be decompose into the sum of powers of 2. So here is should be written powers of 2 until number, which will be equal or less than 10443.

2⁰ = 1

2¹ = 2

2² = 4

2³ = 8

2⁴ = 16

2⁵ = 32

2⁶ = 64

2⁷ = 128

2⁸ = 256

2⁹= 512

2¹⁰ = 1024

2¹¹ = 2048

2¹² = 4096

2¹³ = 8192

2¹⁴ = 16384

Power of 2 which is less than 10443 is 2¹³ = 8192, so it should be rewrite step by step, until there are powers of two.

10443 = 8192 (2¹³) + 2048 (2¹¹) + 128 (2⁷) + 64 (2⁶) + 8 (2³) + 2 (2¹) + 1 (2⁰)

Now it should be rewrite in binary (like 1s place, 2s place, 4 place) until number less than 10443, but from right to left:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 8192 | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

Answer:

Converting 10443 into binary is 10100011001011

Converting 10443 into hex:

For hex the base is 16. This number should be decompose into the sum of powers of 16:

16⁰ = 1

16¹ = 16

16² = 256

16³ = 4096

16⁴ = 65536

Power of 16 which is less than 10443 is 4096

10443 = 4096\*2 (8192) + 256\*8 (2048) + 16\*12 (192) + 1\*11

Digits 10 and above:

A = 10

B = 11

C = 12

D = 13

|  |  |  |  |
| --- | --- | --- | --- |
| 2 | 8 | C | B |
| 4096 | 256 | 16 | 1 |

Answer: 10443 = 28CB hex

**B.**

Addition and subtraction using decimal number 99999 and 10443 number in binary.

First, it should be found binary of 99999 and 10443 as in Task A. 10443 already converted into binary.

So converting 99999 into binary:

2⁰ = 1

2¹ = 2

2² = 4

2³ = 8

2⁴ = 16

2⁵ = 32

2⁶ = 64

2⁷ = 128

2⁸ = 256

2⁹= 512

2¹⁰ = 1024

2¹¹ = 2048

2¹² = 4096

2¹³ = 8192

2¹⁴ = 16384

2¹⁵ = 32768

2¹⁶ = 65536

2¹⁷ = 131072

99999 = 65536 (2¹⁶) + 32768 (2¹⁵) + 1024 (2¹⁰) + 512 (2⁹) + 128 (2⁷) + 16 (2⁴) + 8 (2³) + 4 (2²) + 2 (2¹) + 1 (2⁰)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 65536 | 32768 | 16384 | 8192 | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

99999 = 11000011010011111 in binary

Addition of binary numbers of 10443 and 99999:

Answer: 11011000001101010 = 110442 in binominal (10443 + 99999)

10001010101010100 = in binominal (10443 - 99999)

**C.** In life, the types of system, that is more suitable for the situation, are applied. The hex is mainly used for coding colors in CSS. Here users can use the decimal system, but the answer will be longer and more inconvenient than hexadecimal.

**Task 4.**

Given number 45237 and ID 443

0 1 2 3 3 4 4 4 5 7

X = 2

1. Midpoint is 3

10/2 = 4.5 fifth number is a midpoint

2. x ˂ midpoint (2 ˂ 3) The range on the right should be ignored (3 - 7)

3. midpoint is 1

Midpoint less than X, so it should be cutted until midpoint = 2

0 1 2 3 → 2 3

2 (number of items left)/2 = 1 (place of the item which is midpoint)

X = 2

Midpoint = 2

2=2

**Task 6.**

Spiral model is also known as the metamodel because it includes all other SDLC models. In schematic diagram, it looks like a spiral with many loops, which is why it is called a spiral. Each cycle of the spiral is called a phase of the software development process. This model is able to handle risks

Waterfall is a traditional methodology, the development of a project is divided into stages: from the analysis of system requirements to the release of the product.

Each step is a separate phase of software development, and the team must complete one phase before moving on to the next. In a "pure" implementation of Waterfall, it is forbidden to return to the previous stage - you can only "go with the flow" to go through the full development cycle.

Differences:

Waterfall:

1. It works in sequential method.

2. Waterfall model is applicable for small project.

3. There is high amount risk in waterfall model.

Spiral:

1. While Spiral model is used for large projects.

2. There is low amount risk in spiral model.

3. It works in evolutionary method.

**Task 7**.

In a Star topology, each device on the network is connected to a central device called a hub. In a star topology, direct communication between devices is not allowed, only through a hub.

In a Ring topology, each device is associated with two devices on either side of it. The device structure forms a ring, which is why it is known as a ring topology. If a device wants to send data to another device, it sends data in one direction, each device in a ring topology has a repeater, if the received data is for another device, the repeater forwards this data until the intended device receives it.

Star topology benefits

1. Price. Low cost due to the fact that each device needs only one I / O port, which must be connected to the hub using one channel.

2. Easy installation

3. Reliable, if one link doesn't work, other links will work fine.

4. Easy link identification.

Disadvantages of Star Topology

1. The whole system depends on the hub, none of the devices can work without the hub if it stops working normally.

2. The hub requires more resources and regular maintenance because it is the central system of a star topology.

Ring topology benefits

1. Easy installation.

2. Management is easier as only two links need to be changed to add or remove a device from the topology.

Disadvantages of ring topology

1. A communication failure can lead to a failure of the entire network as the signal will not propagate forward due to the failure.

2. All data circulates around the ring, so there may be data traffic problems

Differences:

Star Topology

1. In star topology, only hub is failure point.

2. The information is travel from central hub or router to all the nodes.

3. A new cable is added to the central hub to add a new node.

Ring Topology

1. In ring topology, every nodes are failure point.

2. In ring topology, the information is travel from nodes to nodes in ring manner in one direction.

3. Whereas to add a new node in ring topology, the connection must be broken.

**Task 5.**

Paged memory management:

Page allocation divides the computer's primary memory into fixed-size blocks called page frames, and the program's virtual address space into pages of equal size. The hardware memory control block maps pages to frames. Physical memory can be paged while the address space appears to be contiguous. Typically, when managing paged memory, each job is executed in its own address space.

**Referencing:**

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