



Bitwise manipulation: Left shift

Perform a logical left shift of 2 places on the 8-bit binary number: 01101010

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Describe a logical bitwise operation and mask

Bitwise manipulation allows the programmer to work with sets of bits through **logical bitwise operations** and **masks**. These operations are directly supported by the processor, which makes them fast and very efficient.

Part A

Which statement describes a **logical bitwise operation**?

- ☐ An operation that shifts all the bits in a binary string to the left by a specified number of places, where the bits that are shifted out at the end are moved into the other end of the register
- ☐ An operation that shifts all the bits in a binary string to the left by a specified number of places
- ☐ A binary string used in conjunction with a logical bitwise operator to identify or change bits within another binary string
- ☐ The application of a Boolean operator (AND, OR, XOR, NOT) to the individual bits of a binary string

Part B

Which statement describes a **mask**?

- ☐ Shifts all of the bits in a binary string to the left by a specified number of places
 - ☐ The application of a Boolean operator (AND, OR, XOR, NOT) to the individual bits of a binary string
 - ☐ A binary string used in conjunction with a logical bitwise operator to identify or change bits within another binary string
 - ☐ Shifts all of the bits in a binary string to the left by a specified number of places and the bits that are shifted out at the end are moved into the other end of the register
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Apply a bitwise operation

The table below shows a logical bitwise XOR operation being applied to the binary string 01011101 using the mask 01001011.

Work out the binary string that will be the result of an XOR operation on the input string using the given binary string as a mask.

Input	0	1	0	1	1	1	0	1
Mask	0	1	0	0	1	0	1	1
Output	?							

Enter the output binary string after the XOR operation has taken place. Your answer should be an 8-bit binary number.

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Design a bitwise operation with mask

Challenge 2



In ASCII, the 8-bit binary representation for an upper-case **A** is 01000001 and the binary representation of a lower-case **a** is 01100001. Notice how the third-most significant bit is the only difference between the two binary values. If there is a 1 in this position, the letter is lower case. If there is a 0 in this position, the letter is upper case.

Letter A	0	1	0	0	0	0	0	1
Mask	?	?	?	?	?	?	?	?
Letter a	0	1	1	0	0	0	0	1

Design a logical bitwise operation with a suitable binary mask that, when applied to any upper-case ASCII binary value, will change it to the equivalent lower-case ASCII binary value.

Part A

Enter the binary string that will be used as the mask to change an ASCII upper-case letter to an ASCII lower-case letter.

Your answer should be an **8-bit** binary number.

Part B

Which of the following bitwise operations would you use with this mask?

- ☐ XOR
- ☐ NOT
- ☐ AND
- ☐ OR



Bitwise manipulation: Arithmetic shift

Perform an **arithmetic right shift of two places** on the **two's complement** 8-bit binary number: 11001101.

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Bitwise operation for network ID

Bert uses a device on a network that has been assigned the IP address **192.168.1.75**

The subnet mask is **255.255.255.240**

Using these values, perform a logical bitwise **AND** operation to calculate the network ID.

Give your answer as a 4 octet string separated by dots e.g. **203.0.113.24**

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Subnet masking: 1

A small network with a single subnet has been configured with a subnet mask of **255.255.255.0** (or **/24**)

Which of the following pairs of hosts would be on the same network?

- ☐ **192.168.12.120** and **192.168.120.12**
- ☐ **192.168.1.12** and **192.168.1.120**
- ☐ **192.168.1.263** and **192.168.1.136**

Quiz:

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Subnet masking: 2

A network (subnet) has been configured with a subnet mask of **255.255.192.0** (or **/18** in CIDR notation).

Which of the following pairs of hosts would be on the same network (subnet)?

- ☐ **192.128.226.12** and **192.128.128.12**
- ☐ **192.168.200.12** and **192.168.220.12**
- ☐ **192.168.200.13** and **192.168.120.136**
- ☐ **192.168.12.120** and **192.128.12.120**

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