TECHNOSCRIPTS EMBEDDED
Frequently Asked I2C Protocol Interview Questions

I²C (Inter-Integrated Circuit), blazoned I-squared-C is an asynchronous, multi-master, packet-switched multi-slave, single-ended, serial computer bus developed in 1982 by Philips Semiconductor (now NXP Semiconductors).

It is widely used for joining lower-speed peripheral ICs to processors and microcontrollers in short-distance, intra-board communication. Since October 10, 2006, no licensing fees have been asked to implement the I²C protocol. However, fees are compelled to obtain I²C slave addresses allocated by NXP.

Some rivals, such as Siemens AG (later Infineon Technologies AG, nowadays Intel mobile communications), NEC, Texas Instruments, STMicroelectronics (formerly SGS-Thomson), Motorola (later Free scale, now merged with NXP), Nordic Semiconductor, and Intersil, have added compatible I²C products to the market since the mid-1990s.

1. Two-wire interface is also known as _____
a) UART
b) SPI
c) I2C
d) USART

Answer: c
Explanation: The i2c protocol is also recognized as the two-wire interface which is a simple serial communication protocol that uses just pins of a microcontroller namely SCL and SDA.

2. I2c will address a large number of slave devices.
a) True
b) False

Answer: a
Explanation: This protocol will direct a large number of slave devices that are equated to the same bus.

3. SDA shows a _____transition when the clock line SCL is high.
a) high to low
b) low to high
c) low to low
d) high to high

Answer: a

Explanation: SDA shows a high-to-low transition when the clock line SCL is high. Under normal conditions, this does not appear as you can see in the subsequent clock pulses that the data line is steady in one state, either high or low when the clock line is high.

4. Inter-Integrated Circuit is a _____
a) Single master, single slave
b) Multi-master, single slave
c) Single master, multi-slave
d) Multi-master, multi-slave

Answer: d
Explanation: I2C notable as I-squared-C, is a multi-master, multi salve. It is used for joining lower-speed peripheral ICs to processors and microcontrollers in a small range, intraband communication within a system board.

5. Typical voltages used are _____
a) 5v
b) 3.3v
c) 5v or 3.3v
d) 2.5v

Answer: c
Explanation: I2C uses just two bidirectional open-drain lines means that two lines are neither connected to Vcc nor connected to ground, SDA, and SCL. Standard voltages used are 5v or 3.3v, although a system with other voltages is allowed.

6. What is the speed of the I2C bus?
a) 100 kbits/s
b) 10 kbits/s
c) 75 kbits/s
d) 100 kbit/s and 10 kbit/s

Answer: d
Explanation: Common I2C bus peed rates are the 100 kbit/s standard mode and the 10 kits/slow-speed mode, but arbitrarily lowering clock frequencies is also allowed.

7. Master transmits means _____
a) The master node is sending data to a slave
b) The master node is receiving data from the slave
c) Slave node is transmitting data to the master
d) Slave node is sending data to the master

Answer: a

Explanation: There may be four potential modes of action for a given bus device, although most devices only use a single role and its two modes:
-> Master transmits – The master node is transmitting data to a slave
-> Maser receives – Master node is receiving data from the slave
-> Slave transmit – slave node is transmitting data to the master
-> Slave receive – The slave node is sending data to the master.

8. Who sends the start bit?
a) Master receives
b) Master transmits
c) Slave transmits
d) Slave receives

Answer: b
Explanation: The master is initially in master transmit mode by sending a start bit followed by the 7-bit address of the slave.

9. What is the I2C messaging example?
a) 24c32 EPROM
b) 24c32 EEPROM
c) 24c33 EEPROM
d) 24c33 EPROM

Answer: b
Explanation: The 24c32 EEPROM, practices two request bytes that are called Address high and Address Low. These bytes are utilized to address bytes within the 32 kbit supported by that EEPROM which has inbuilt I2C pins.

10. Are pull-up registers required in I2C?
a) True
b) False

Answer: a
Explanation: At the physical layer, both SCL and SDA lines are of open drain design, thus pull-up resistors are needed.

11. How many kinds of addressing structures are there in I2C?
a) 4 types
b) 3 types
c) 2 types
d) 5 types

Answer: c

Explanation: There are 2 markings/addressing mode –> 7-bit addressing mode
–> 10-bit addressing mode.

12. All operating modes work under _____
a) 11 kbit/s
b) 100 kbit/s
c) 15 kbit/s
d) 150 kbit/s

Answer: b
Explanation: There are different operating modes for I2C communication. All are cooperative in that the 100 kbit/s standard mode is always used.

13. Which mode is highly cooperative and simply tightens?
a) Fast mode
b) High-speed mode
c) Ultrafast mode
d) Both fast and high-speed mode

Answer: a
Explanation: Quick mode is highly cooperative and simply tightens several of the timing parameters to achieve 400 kbit/s speed.

14. What is the speed for fast mode?
a) 100 kbit/s
b) 400 kbit/s
c) 150 kbit/s
d) 200 kbit/s

Answer: b
Explanation: Quick mode is highly compatible and tightens several of the timing parameters to attain 400 kbit/s speed.

15. What is the speed for High-Speed mode?
a) 100 kbit/s
b) 3.4 Mbit/s
c) 150 kbit/s
d) 200 kbit/s

Answer: b
Explanation: High-speed mode is compatible with normal I2C devices on the same bus, but requires the master to have an active pull-up on the clock line which is enabled during high-speed transfers.

16. What do you mean by I2C communication? Explain with its diagram.
I2C stands for inter-IC communication. It is two wires i.e. SDA and SCL half-duplex communication protocol. It is a single and multi-master and slave communication protocol.

17. What is the application of I2C protocol?
It is connected with serial RAM, LCD, and EEPROM and it is used within the television sets.

18. Which of the following are the three hardware signals?
Ans: START, STOP, ACKNOWLEDGE.

19. Which pin provides the reference clock for the transfer of data?
Ans: SCL provides the reference clock for the transfer of data.

20. Can devices be added and removed while the system is running in I2C?
Ans: Hot swapping is possible in I2C protocol.

21. What is the standard bus speed in I2C?
Ans: a standard bus speed is 100Kbps, fast mode is 400Kbps, fast mode plus is 1Mbps, high-speed mode is 4Mbps, and Ultra speed mode is 5 Mbps.

22. What is bus arbitration?
Ans: Arbitration is the process of avoiding conflict with the data on the bus when multi master start communication at the same time. In the arbitration – which is the lowest address of the salve, that salve will communication continue and others will lose the arbitration.

23. Advantages and limitations of I2C communication?
Ans: 1. Using I2C we can connect more slaves than SPI.
2. Cost-effective compared to SPI.SPI
3. Different speeds available.
4. NO need for any GPIO pins.
5. hardware design implementation is simpler than SPI because of 2-wire communication
6. Supports Multi-master Communication
7. More complexity to write a program 8. Transfer of data speed (100 Kbps) is less than SPI (1 Mbps)

24. How many devices can be connected in a standard I2C communication?
Ans: Theoretically we can connect up to 127 devices for 7Bit addresses and 2 ^10 devices will connect for 10Bit addresses. But practically depends on Capacitance load. If the capacitance load is increased the speed will be reduced

25. Is it possible to have multiple masters in I2C?
Ans: Multi-master is possible in I2C communication using the Arbitration process.

26. What is the maximum distance of the I2C bus?

Ans: This depends on the load of the bus and the speed you run at. In typical applications, the length is a few meters (9-12ft). The maximum capacitive load has been specified (see also the electrical specs in the I2C FAQ). Another thing to be taken into account is the amount of noise picked up by long cabling. This noise can disturb the signal transmitted over the bus so badly that it becomes unreadable.

The length can be increased significantly by running at a lower clock frequency. One particular application – clocked at about 500Hz – had a bus length of about 100m (300ft). If you are careful in routing your PCBs and use proper cabling (twisted pair and/or shielded cable), you can also gain some length. If you need to go far at high speed, you can use an active current source instead of a simple pull-up resistor. Philips has a standalone product for this purpose. Using a charge pump also reduces "ghost signals" caused by reflections at the end of the bus lines.

27. Can I do galvanic decoupling of my I2C bus?

This is possible. The circuit is rather complex due to the bi-directional nature of the I2C bus. The following figure shows a possible solution:

Component Values:

5 and 5' : PNP like 2n2219 or BC557

6 and 6' : NPN like 2n2222 or BC 547

1 and 1' : 270 Ohm

2 and 2' : 3300 Ohm

3 and 3' : 1800 Ohm

4 and 4' : 1000 Ohm

Optocouplers : 6n139 , 4n27 or Til 111

Note: Since the speed of the I2C bus can be rather high, it is recommended to use a fast optocoupler. However, this circuit will not work on speeds higher than 10KHz. A 6N139 will do the job in all cases. The two PNP and the two NPN transistors can be any standard type, e.g. 2N2219 and 2N2222 (USA) or BC547 and BC557 (EUROPE).

28. How can I monitor the I2C bus?

Ans: There are a few commercial I2C monitors/debuggers around that can do this.

There is another possibility to do this: By using the stand-alone I2C controller PCF8584 from Philips. This chip has a certain mode in which it does not take part in the real I2C action but only records what is going on. It listens to all addresses but does not generate any acknowledgment. Using some software routines and a MCU you could build a universal I2C data logger.