

Signals and Systems Exam ACDA 4009

By Frazer Graham – 1907690

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Q1)

a) The amplifier in figure 1.1 is an inverting amplifier

b) The gain can be calculated using the equation
$$G = -\frac{R_F}{R_I}$$

c) $-\frac{29k}{2k} = -14.5$ gain = -14.5

d) $V_O = -\left(\frac{R_F}{R_I}\right)V_I$ $-\left(\frac{29k}{2k}\right) \times 0.345 = -5.0025V$

The output voltage would be -5.0025V

e) The phase of the output signal would have been shifted by ~~180~~ degrees 180 degrees.

Q2)

a) The amplifier in figure 1.2 is a non-inverting amplifier.

b) The gain can be calculated using the equation
$$G = 1 + \frac{R_1}{R_2}$$

c) $1 + \frac{27k}{2k} = 14.5$ gain = 14.5

d) $V_O = 1 + \left(\frac{R_1}{R_2}\right) \times V_I$ $1 + \left(\frac{27k}{2k}\right) 0.62 = 9.37V$

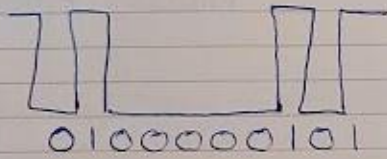
The output voltage would be 9.37V.

e) There is no phase shift from a non-inverting amplifier. Therefore the output phase should be the same as the input phase.

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Q2

a)



The data being transmitted is
01000001

b)

1010000010

01000001

01000001

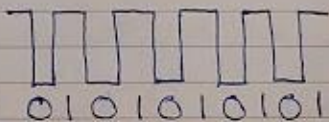
4 1

41 = A

- ① Flip message
- ② Remove parity bits
- ③ Divide into hexadecimal
- ④ Look up ASCII table

Q3

a)



The data being transmitted is
01010101

b)

1010101010

01010101

01010101

5 5

55 = U

- ① Flip message
- ② Remove parity bits
- ③ Divide into hexadecimal
- ④ Look up ASCII table

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Q3) The transmission protocol for figure 3 is

a) an I2C protocol.

b) An I2C is a synchronous, multi-master, multi-slave, packet switched, single ended, serial computer bus.

~~An I2C is also known as a serial communication bus.~~

I2C is known as a synchronous serial protocol, with an SPI protocol.

c) SDA = Serial data line

SCL = Serial clock line

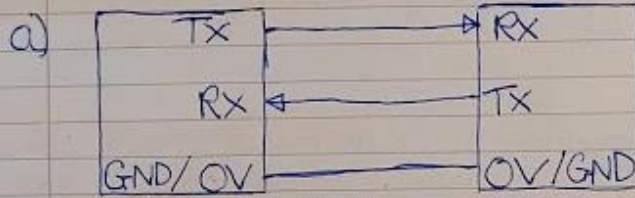
The SCL ~~line~~ is a clock signal which ^{synchronise} the data transfer between the devices, usually this is controlled by the master. The SDA transfers the data between the devices.

D) Examples of I2C can be found in:

- Micro-controllers
- EEPROM's
- I/O interfaces
- Accessing real time clocks
- Turning on & off power supply of system components.

Q4

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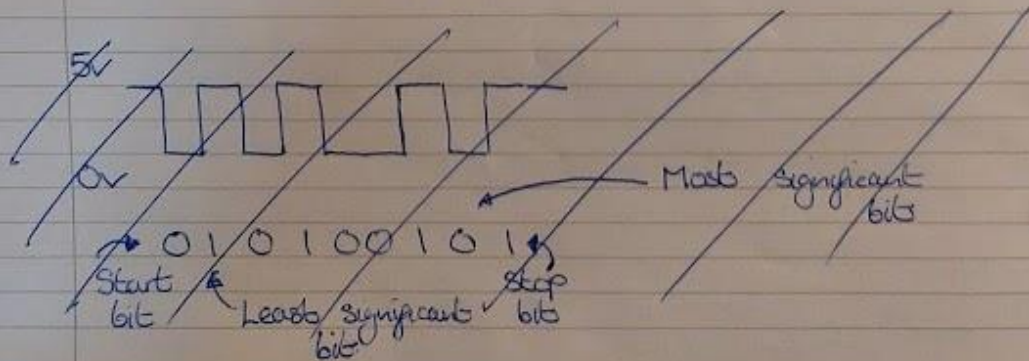
RS ~~323~~²³² transmission system

b) RS 232 is a serial communication protocol, however it is an Asynchronous data receiver & transmitter. It is a point-to-point connection, meaning it can only connect to one device.

c) Examples of RS 232 can be found in:

- Video Terminals
- Computers
- Modems
- Scientific equipments
- Industrial control equipment

d) A5 = A = 1010 5 = 0101 ① combined hexadecimal
 1010 0101
 Add start bits "0" & stop bits "1"
 1101001010
 RS 323 starts with the most significant bits therefore I need to flip the code.
 0101001011



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The transmission would be:

