Conversion and Coding

Please solve the following exercises individually.

The memory of a digital circuit has the following contents. Please show its hexadecimal and its ASCII representation.

Binary (one bit per box)

0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1
0	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0
0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1
0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0
0	1	1	0	0	1	1	1	0	1	1	0	0	1	0	1
0	1	1	0	1	0	0	0	0	1	1	0	0	1	0	1
0	1	1	0	1	0	0	1	0	1	1	0	1	1	0	1

Hexadecimal (two hex digits per box)

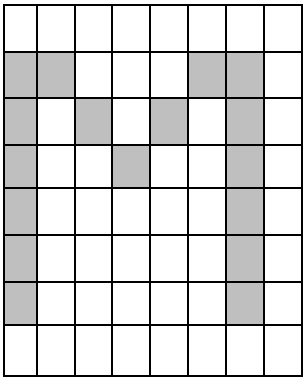
44														

ASCII (one character per box)

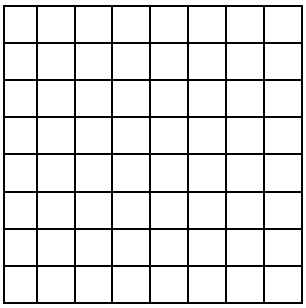
D														

Please encode the first letter of your name in the same way.

The characters should be encoded as follows:



=	0000 0000	=	00
=	1100 0110	=	C6
=	1010 1010	=	AA
=	1001 0010	=	92
=	1000 0010	=	82
=	1000 0010	=	82
=	1000 0010	=	82
=	0000 0000	=	00



=		=	
=		=	
=		=	
=		=	
=		=	
=		=	
=		=	
=		=	

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The memory of a digital circuit has the following contents. Please show its hexadecimal and its ASCII representation.

Binary (one bit per box)

0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1
0	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0
0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1
0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0
0	1	1	0	0	1	1	1	0	1	1	0	0	1	0	1
0	1	1	0	1	0	0	0	0	1	1	0	0	1	0	1
0	1	1	0	1	0	0	1	0	1	1	0	1	1	0	1

Hexadecimal (two hex digits per box)

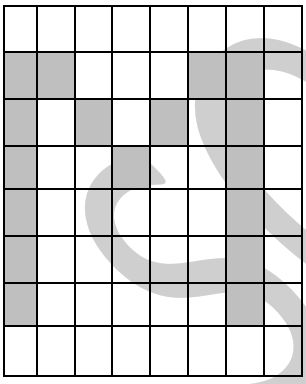
44	61	73	20	69	73	74	20	67	65	68	65	69	6D

ASCII (one character per box)

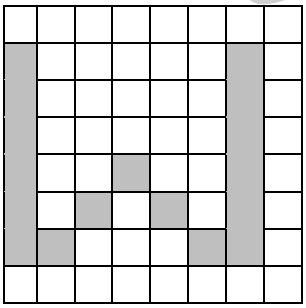
D	a	s		i	s	t		g	e	h	e	i	m

Please encode the first letter of your name in the same way.

The characters should be encoded as follows:



=	0000 0000	=	00
=	1100 0110	=	C6
=	1010 1010	=	AA
=	1001 0010	=	92
=	1000 0010	=	82
=	1000 0010	=	82
=	1000 0010	=	82
=	0000 0000	=	00



=	0000 0000	=	00
=	1000 0010	=	82
=	1000 0010	=	82
=	1000 0010	=	82
=	1001 0010	=	92
=	1010 1010	=	AA
=	1100 0110	=	C6
=	0000 0000	=	00

Text Exercises

Please do the following exercises individually.

Text Exercise I

You are designing a digital circuit which reads the serial number of tickets. The serial number is printed as a bar code on the ticket. There are never more than thousand tickets per session. How many bits do you need for your digital circuit?

Text Exercise II

You have to encode the colors *white*, *silver*, *grey*, *red*, *green*, *blue*, *yellow*, *brown* and *pink*. How many bits will you need at least? Give an example for a possible coding scheme.

Text Exercise III

You have to encode the letters *A* … *Z* and the digits *0* … *1*. How many bits do you need for your code? How many characters of your code do you used? How many characters are unused? How many per cents of your code do you use?

Text Exercise IV

The state of a dishwasher is encoded with four bits.

1st bit:	door is closed
2nd bit:	detergent[1] available
3rd bit:	water available
4th bit:	dishes are clean

Please encode the following states:

- Door closed, detergent and water available, dishes not clean: $0111_{bin} = 7_{hex}$
- Door closed, detergent and water not available, dishes not clean:
- Door open, detergent and water available, dishes not clean:
- Door closed, detergent not available, water available, dishes clean:

[1] Waschmittel

Text Exercises

Please do the following exercises individually.

Text Exercise I

You are designing a digital circuit which reads the serial number of tickets. The serial number is printed as a bar code on the ticket. There are never more than thousand tickets per session. How many bits do you need for your digital circuit?

Thousand is not a power of two. The next power of two is $2^{10} = 1024$. Our digital circuit needs ten bits.

Text Exercise II

You have to encode the colors *white*, *silver*, *grey*, *red*, *green*, *blue*, *yellow*, *brown* and *pink*. How many bits will you need at least? Give an example for a possible coding scheme.

We have nine colors. Therefore we need five bits since $2^4 = 16$. A possible coding scheme is: white=0, silver=1, grey=2, red=3, green=4, blue=5, yellow=6, brown=7 and pink=8.

Text Exercise III

You have to encode the letters *A* … *Z* and the digits *0* … *1*. How many bits do you need for your code? How many characters of your code do you used? How many characters are unused? How many per cents of your code do you use?

There are 26 letters and ten digits. We need six bits: $2^6 = 64$. We need 36 characters for our code. 28 characters are unused. We use about 56% of our code.

Text Exercise IV

The state of a dishwasher is encoded with four bits.

1st bit:	door is closed
2nd bit:	detergent[1] available
3rd bit:	water available
4th bit:	dishes are clean

Please encode the following states:

- Door closed, detergent and water available, dishes not clean: $0111_{bin} = 7_{hex}$
- Door closed, detergent and water not available, dishes not clean: $0001_{bin} = 1_{hex}$
- Door open, detergent and water available, dishes not clean: $0110_{bin} = 6_{hex}$
- Door closed, detergent not available, water available, dishes clean: $1101_{bin} = D_{hex}$

[1] Waschmittel