CSCU9V4 Systems - Tutorial 1: ANSWERS
Week beginning 5th February 2018.

1. The following is a 32-bit binary number.

01000001010000100100001101000100

Write it in hexadecimal. 0x41424344

What might it signify when stored in a computer? (How many different possible meanings can you think of?) Is there any way of telling what its intended meaning is?

Many possibilities, from a 2's complement 32 bit number, to an unsigned 32 bit number, to a 32 bit floating point number to 4 ASCII characters, or a piece of program code, or simply some bit string representing something inside a program. Note that it looks most like ABCD in ASCII!

2. Showing all workings, convert the following decimal numbers first to binary, and then to hexadecimal:

     1, 2, 4, 8, 32, 128, 256, 7, 10, 100, 127, 255, 65535

Would it have been easier to convert them to hexadecimal first and then to binary?

To convert to binary, keep dividing by 2, and use the numbers in the remainders in reverse order. Note that 1,2,4, and 8, 7 are the same in decimal and hexadecimal.

128 = 0x80 (8 * 16)
256 = 0x100
100 = 0x64
127 = 0x7F
255 = 0xFF
65535 = 0xFFFF (note that 65535= 65536 – 1 = (16^4) - 1

     Convert the following four 8-bit binary numbers into decimal, and also into hexadecimal: (the grouping of the numbers into nibbles is just to make it easier to read, and doesn't affect the interpretation):

     0000 1000 = 0x08 = 8
     0000 1011 = 0x0A = 10
     0101 0101 = 0x55 = 85
     1010 1010 = 0xAA = 170

Would it have been easier to convert them to hexadecimal first, then to decimal?

Convert the following hexadecimal numbers to decimal, and also to binary:

     08x   09x   10x   30x
     40x   0Ax   A0x   CFx

Multiply first digit by 16 and add second: so CF = 12 * 16 + 15 = 207
Binary: CF=207=11001111

3. An HTML file for a web page might have contained the following tag (to give colours for the main body of the web page):

```
<body bgcolor="#ffffff" text="#000000"
link="#cc00cc" vlink="#900090">
```

What colour
  ➢ is the background of the web page? White
  ➢ is the text on the web page? Black
  ➢ are the links on the web page? Purple
  ➢ do the links turn to once they have been visited (the VLINK attribute)? A paler shade of purple

4. What is the range of numbers that can be represented by a 16-bit word:
  • As a pure non-negative integer 0 to 65535
  • As a 2's complement integer -32768 to 32767
  • If it is divided up into 4 bit nibbles, and each is used to hold a decimal digit between 0 and 9 0 to 9999
  • If it is divided up into 4 bit nibbles, and each is used to hold a hexadecimal digit between 0 and F 0 to 0xFFFF, that is 0 to 65535
  • If it is divided as above, and the first 4 bit nibble is used to store a sign (+/-), and the other three to store a digit. –0xFFF to +0xFFF , that is -4095 to + 4095, with two different representations for 0.

5. The hexadecimal below represents a string in a programming language (not Java) which uses ASCII notation.

What text does the string have in it?
417072696C2073686F7765727320676F206F6E20666F7220686F7572732100x
Answer: "April showers go on for hours!" Note the null character to terminate the string.

Using ASCII, convert the following message into hexadecimal notation:
In July the sun is hot. Is it shining? No it's not!
Answer:
Null terminated:
496E204A756C79207468652073756E20697320686F742E204973206974207368696
E696E673F204E6F2069742773206E6F742100x

Counted: 51 chars
33496E204A756C79207468652073756E20697320686F742E2049732069742073686
96E696E673F204E6F2069742773206E6F7421x

What would the string look like if it was (i) null-terminated (= NUL terminated), (ii) counted. What problem might one have with a long counted string? Null terminated strings have 00 at the end. The problem with counting the length of the string is deciding how many bit to use for the count, as this implies a limit on the string length (of $(2^{(no\ of\ bits)}) - 1$).

Table of ASCII Characters

```
                        (least significant 4 bits)
      0   1   2   3   4   5   6   7   8   9   A   B   C   D   E   F
  _____
0 | NUL SOH STX ETX EOT ENQ ACK BEL BS  HT  LF  VT  FF  CR  SO  SI
1 | DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM  SUB ESC FS  GS  RS  US
2 | SP  !   "   #   $   %   &   '   (   )   *   +   ,   -   .   /
3 | 0   1   2   3   4   5   6   7   8   9   :   ;   <   =   >   ?
4 | @   A   B   C   D   E   F   G   H   I   J   K   L   M   N   O
5 | P   Q   R   S   T   U   V   W   X   Y   Z   [   \   ]   ^   _
6 | `   a   b   c   d   e   f   g   h   i   j   k   l   m   n   o
7 | p   q   r   s   t   u   v   w   x   y   z   {   |   }   ~   DEL
```