Robert Heeter
ENGI 301 Practical Electrical Engineering
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Problem Set #3

1. See annotated image question_1.png.

2. See next page.

3. See next page.

4. See below:
    a. *What aspect of the Python style guide do you disagree with most and why?*
    There is not much that I disagree with in the Python style guide; most of the
    guidelines seem to be very reasonable and the provided examples clearly
    demonstrate the adverse effect of bad formatting on readability. There were a few
    minor points that I disagreed with; I did not know that tabs should not be used for
    indentation. I think that most IDEs/code editors use the tab key to add spaces (but
    I am not sure), since I only use tabs for indenting since it is much easier than
    typing multiple spaces. I also partly disagree with the point that wildcard imports
    (i.e. *from <module> import *)* should not be used; for prototyping, it is much
    easier to import multiple names/functions, though for polished/published code the
    wildcard imports should be removed for clarity. Lastly, I disagree with the point
    that inline comments should be avoided; for engineering/scientific work, inline
    comments are very useful for explaining variables in the context in which they are
    used, and for including units for variables.

    b. *Do you agree that whitespace should matter in Python and why?*
    Yes I definitely agree that whitespace should matter in Python. Whitespace is
    important for visually breaking up and organizing sections of code, especially in
    cases where a programmer needs to define multiple functions or classes, or is
    using nested if, else, for, while, etc. statements. I personally use white space in
    Python to separate logically-connected blocks of code, since it is more
    readable/approachable/understandable than a large wall of text.

    c. *What is the most interesting thing you found in the style guide and why?*
    While it is not often used, I thought the section about adding a line break before
    binary operators, such as + or −, rather than after was very clever and was not
    something that I ever considered. In the past, I have typically added a line break
    after binary operators, but the example shown in the style guide has convinced me

to change my habits since it is much more readable if the line break comes before the binary operator. While not the most interesting, I also thought it is important to note that keeping comments up to date is crucial! I am guilty of not keeping my comments up to date, and while it is a tedious process it is better than forgetting to update the comments and having trouble understanding my code later. I have also heard that some large tech companies encourage their employees to write code in an organized and readable way such that comments can be kept to a minimum (i.e. the code is self-explanatory), but that is not always possible.

2 Binary

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
a. 64206	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	0	$_2$
b. 48879	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	$_2$
c. 57005	1	1	0	1	1	1	1	0	1	0	1	0	1	1	0	1	$_2$
d. 34370	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	$_2$
e. 79225	1	0	0	1	1	0	1	0	1	0	1	1	1	1	0	0	1 $_2$

Octal

$$\overset{1}{\div 8}\ \overset{2}{\div 8}\ \overset{3}{\div 8}\ \overset{4}{\div 8}\ \overset{5}{\div 8}\ \overset{6}{\div 8}$$

a. 64206 → 6 1 3 5 7 1 → 175316_8

b. 48879 → 7 5 3 7 3 1 → 137357_8

c. 57005 → 5 5 2 7 5 1 → 157255_8

d. 34370 → 2 0 1 3 0 1 → 103102_8

e. 79225 → 1 7 5 2 3 2 → 232571_8

Hexadecimal (big endian)

$$\div 16\ \div 16\ \div 16\ \div 16$$

a. 64206 → 14 12 10 15 → $FACE_{16}$

b. 48879 → 15 14 14 11 → $BEEF_{16}$

c. 57005 → 13 10 14 13 → $DEAD_{16}$

d. 34370 → 2 4 6 8 → 8642_{16}

e. 79225 → 9 7 5 3 1 → 13579_{16}

3. a. Decimal (unsigned)

   i. 0x2A (hex) → $\left.\begin{array}{l} A \cdot 1 = 10 \\ 2 \cdot 16 = 32 \end{array}\right\}$ $\boxed{42_{10}}$

   ii. 0xFF (hex) → $\left.\begin{array}{l} F \cdot 1 = 15 \\ F \cdot 16 = 240 \end{array}\right\}$ $\boxed{255_{10}}$

   iii. 0111 1110 0111 → $\boxed{2023_{10}}$
      11 10 9 8 7 6 5 4 3 2 1 0

   iv. 1010 1100 1110 1101 → $\boxed{44269_{10}}$
      15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

b. Decimal (signed)

   i. 0x2A (hex) → 101010 → $\overset{(+)}{\downarrow}$ 00101010 → $\boxed{42_{10}}$

   ii. 0xFF (hex) → 11111111 $\overset{\nwarrow \ominus}{\longrightarrow}$ $\boxed{-1_{10}}$

   iii. $\overset{\nearrow \oplus}{}$ 0111 1110 0111 → $\boxed{2023_{10}}$

   iv. 1010 1100 1110 1101 $\longrightarrow$ $\boxed{-21267_{10}}$
      $\overset{\nwarrow \ominus}{}$

c. ASCII characters

   i. 0x49 (hex) → $\left.\begin{array}{l} 9 \cdot 1 = 9 \\ 4 \cdot 16 = 64 \end{array}\right\}$ 73_{10} → $\boxed{I}$ (uppercase)

   ii. 0110 1100 0110 1111 0111 0110 0110 0101 → 1819244133_{10}
      7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

      108_{10} 111_{10} 118_{10} 101_{10}

      $\boxed{\text{l}\quad\quad\text{o}\quad\quad\text{v}\quad\quad\text{e}}$ (lowercase)

   iii. 0x 45 4E 47 49
      69_{10} 78_{10} 71_{10} 73_{10}

      $\boxed{\text{E}\quad\text{N}\quad\text{G}\quad\text{I}}$ (uppercase) $\boxed{\text{"I love ENGI 301 "!}}$

   iv. 3354673 → 0x 333031
      51_{10} 48_{10} 49_{10}

      $\boxed{3\quad\quad 0\quad\quad 1}$