

Review Questions for Midterm Exam

Use the order of operations to simplify the following expression

1.
$$\frac{[-75 - (|-8| \times 8 \div 16)][-15 - (\sqrt{64} \div -2)]}{(943 - 948)^3 - 2^4 \div 8}$$

Solve the following expressions

2.
$$\frac{10^{-23} \times 10^{-16} \times 10^{31}}{10^{17} \times 10^{13} \times 10^{-27}}$$

$$\frac{\left(\frac{10^{16}}{10^{-25}}\right)^{-6}}{\left(\frac{10^{-18}}{10^{22}}\right)^3}$$

3.
$$\frac{18 \times 12 \times 10^6}{27 \times 10^8 + (8.2 \times 10^2)^5}$$

$$4. \frac{1}{6.280 \times 10^2} + \frac{1}{5160} - \sqrt{9720}$$

$$5. \frac{\frac{1}{\frac{1}{7580} - \frac{1}{5610} + \frac{1}{3850}}}{1}$$

Convert to the following units, final answers should be in scientific notation

$$6. 4.17 \times 10^{-9} \text{ A} = \text{_____ PA} = \text{_____ } \mu\text{A}$$

$$7. 987.2 \text{ pounds} = \text{_____ ag}$$

8. Convert the following

Decimal Number	Scientific Notation
0.000008601	
	5.71×10^{-7}

9. Fill in the following table by converting the known numbers

Decimal (Base 10)	Binary (Base 2)	Octal (Base 8)	Hexadecimal (Base 16)
433_{10}			
	100110_2		
		165_8	
			$3EC_{16}$

Compute the following in the given base

10. $71456_8 + 20317_8$

11. $A3B92F_{16} + 83CD0E_{16}$

12. $1100011_2 + 1011011_2$

13. $101110_2 \div 101_2$

14. $732540_8 - 164273_8$

15. $8C90A3_{16} - 231A79_{16}$

16. $1110011_2 - 0101101_2$

17. $1010110_2 \times 1011_2$

18. $1101101_2 - 1001010_2$ (Use the one's complement)

19. $1010110_2 - 1010001_2$ (Use the two's complement)

20. $964805_{10} - 697123_{10}$ (Use the nine's complement)

21. $739618_{10} - 428561_{10}$ (Use the ten's complement)

Also questions on conversion between percent and decimal, rounding, significant figures, scientific notation, powers of 10....

$$\textcircled{1} \frac{[-75 - (|-8| \times 8 \div 16)] [-15 - (\sqrt{64} \div -2)]}{(943 - 948)^3 - 2^4 \div 8}$$

$$\frac{[-75 - (8 \times 8 \div 16)] [-15 - (8 \div -2)]}{(-5)^3 - 16 \div 8}$$

$$\frac{[-75 - (64 \div 16)] [-15 - (-4)]}{-125 - 2} = \frac{[-75 - 4] [-15 + 4]}{-127}$$

$$= \frac{(-79)(-11)}{-127} = \frac{869}{-127}$$

$$\textcircled{2} \frac{10^{-23} \times 10^{-16} \times 10^{31}}{10^{17} \times 10^{13} \times 10^{-27}} = \frac{10^{31-23-16}}{10^{17+13-27}} = \frac{10^{-8}}{10^3} = 10^{-8-3} = 10^{-11} \text{ or } \frac{1}{10^{11}}$$

$$\frac{\left(\frac{10^{16}}{10^{-25}}\right)^{-6}}{\left(\frac{10^{-18}}{10^{22}}\right)^3} = \frac{[10^{16-(-25)}]^{-6}}{[10^{-18-(22)}]^3} = \frac{(10^{41})^{-6}}{(10^{-40})^3} = \frac{10^{-246}}{10^{-120}} = 10^{-246-(-120)} = 10^{-126} \text{ or } \frac{1}{10^{126}}$$

$$\begin{aligned}
 \textcircled{3} \quad \frac{18 \times 12 \times 10^6}{27 \times 10^8 + (8.2 \times 10^2)^5} &= \frac{216 \times 10^6}{27 \times 10^8 + (8.2)^5 \times (10^2)^5} = \frac{216 \times 10^6}{27 \times 10^8 + 3.7074 \times 10^4 \times 10^{10}} \\
 \frac{216 \times 10^6}{27 \times 10^8 + 3.7074 \times 10^{14}} &= \frac{216 \times 10^6}{27 \times 10^8 + 3707400 \times 10^8} = \frac{216 \times 10^6}{3707427 \times 10^8} \\
 &\quad \downarrow \\
 &\quad \underbrace{3.7074 \times 10^{14} \times 10^{-6}}_{= 3707400 \times 10^8} = \frac{216}{3707427} \times 10^6 \times 10^{-8} \\
 &= 0.00005826 \times 10^{-2} \\
 &= \underbrace{0.00005826}_{= 5.8 \times 10^{-7}} \times 10^{-2} \times 10^{-5} \\
 &= \boxed{5.8 \times 10^{-7}}
 \end{aligned}$$

$$\textcircled{4} \quad \frac{1}{6.280 \times 10^2} + \frac{1}{5160} - \sqrt{9720}$$

$$\frac{1}{6.280} \times \frac{1}{10^2} + 1.938 \times 10^{-4} - 98.59$$

$$0.1592 \times 10^{-2} + 1.938 \times 10^{-4} - 98.59$$

$$\underbrace{0.1592 \times 10^{-2} \times 10^{-2}}_{= 15.92 \times 10^{-4}} + 1.938 \times 10^{-4} - 98.59$$

$$15.92 \times 10^{-4} + 1.938 \times 10^{-4} - 98.59$$

$$17.858 \times 10^{-4} - 98.59$$

$$-98.588$$

$$\boxed{-98.59 \text{ or } -9.859 \times 10^1}$$

$$\begin{aligned}
 \textcircled{5} \quad \frac{1}{\frac{1}{7580} - \frac{1}{5610} + \frac{1}{3850}} &= \frac{1}{0.0001312 - 0.00017825 + 0.00025974} \\
 &= \frac{1}{0.00021341} = 4685.81 \\
 &= \boxed{4.686 \times 10^3}
 \end{aligned}$$

$$\textcircled{6} \quad 4.17 \times 10^{-9} \text{ A} \rightarrow \text{pA} \rightarrow \mu\text{A}$$

$$1 \text{ pA} = 10^{-15} \text{ A}$$

$$1 \mu\text{A} = 10^{-6} \text{ A}$$

$$\left(\frac{4.17 \times 10^{-9} \text{ A}}{1} \right) \left(\frac{1 \text{ pA}}{10^{-15} \text{ A}} \right) = \frac{4.17 \times 10^{-9} \text{ pA}}{10^{-15}} = 4.17 \times 10^{-9} \times 10^{15} \text{ pA} = \boxed{4.17 \times 10^{-24} \text{ pA}}$$

$$\left(\frac{4.17 \times 10^{-9} \text{ A}}{1} \right) \left(\frac{1 \mu\text{A}}{10^{-6} \text{ A}} \right) = \frac{4.17 \times 10^{-9} \mu\text{A}}{10^{-6}} = 4.17 \times 10^{-9} \times 10^{+6} \mu\text{A} = \boxed{4.17 \times 10^{-3} \mu\text{A}}$$

⑦ $987.2 \overset{\text{(lbs)}}{\text{pounds}} \rightarrow \text{ag}$

$1 \text{ pound} = 453.6 \text{ g}$
(lbs)

$1 \text{ ag} = 10^{-18} \text{ g}$

$$\left(\frac{987.2 \cancel{\text{lbs}}}{1} \right) \left(\frac{453.6 \text{ g}}{1 \cancel{\text{lb}}} \right) = \frac{987.2 \times 453.6 \text{ g}}{1} = 447793.92 \text{ g}$$

$$\left(\frac{447793.92 \cancel{\text{g}}}{1} \right) \left(\frac{1 \text{ ag}}{10^{-18} \cancel{\text{g}}} \right) = \frac{447793.92 \text{ ag}}{10^{-18}} = \underbrace{447793.92 \times 10^{18}}_{\text{ag}} = 4.478 \times 10^{18} \times 10^5 \text{ ag}$$

$$\boxed{4.478 \times 10^{23} \text{ ag}}$$

⑧ $0.000008601 \rightarrow \text{sci. not.}$

8.601×10^{-6}

$5.71 \times 10^{-7} \rightarrow \text{decimal \#}$

0.000000571

Base 10	Base 2	Base 8	Base 16	Midterms Rev.
433 ₁₀	1 6 5 0001 1011 0001 ₂	000110110001 0 6 6 1 ₈	1 B 1 ₁₆	
38 ₁₀	100110 ₂	1100110 4 6 ₈	00100110 2 6 ₁₆	
117 ₁₀	001 110 101 ₂	165 ₈	000011110101 0 7 5 ₁₆	
1004 ₁₀	3 E C 0011 1110 1100 ₂	001111101100 1 7 5 4 ₈	3 E C ₁₆	

433₁₀ → hex.

$$\begin{array}{r} 27 \text{ (R1)} \\ 16 \overline{) 433} \\ \underline{-32} \\ 113 \\ \underline{-112} \\ 1 \end{array}$$

27 → hex.

$$\begin{array}{r} 1 \text{ (R11)} \\ 16 \overline{) 27} \\ \underline{-16} \\ 11 \end{array}$$

1 → hex.

$$\begin{array}{r} 0 \text{ (R1)} \\ 16 \overline{) 1} \\ \underline{-0} \\ 1 \end{array}$$

1 11 1
1 B 1₁₆

26₁₆ → dec.

$$2 \times 16^1 + 6 \times 16^0$$

$$2 \times 16 + 6 \times 1$$

$$32 + 6 = 38_{10}$$

075₁₆ → dec.

$$7 \times 16^1 + 5 \times 16^0$$

$$7 \times 16 + 5 \times 1$$

$$112 + 5 = 117_{10}$$

3EC₁₆ → dec.

$$3 \times 16^2 + E \times 16^1 + C \times 16^0$$

$$3 \times 256 + 14 \times 16 + 12 \times 1$$

$$768 + 224 + 12 = 1004_{10}$$

$$\begin{array}{r}
 \textcircled{10} \quad \overset{1}{7} \overset{1}{4} \overset{1}{5} \overset{1}{6}_8 \\
 + \quad 20317_8 \\
 \hline
 1917713 \\
 - \quad \quad \quad 8 \quad \quad \quad 8 \\
 \hline
 \boxed{111775_8}
 \end{array}$$

$$\begin{array}{r}
 \textcircled{11} \quad \overset{1}{A} \overset{1}{3} \overset{1}{B} \overset{1}{9} \overset{1}{2} F_{16} \\
 + \quad 83CDOE_{16} \\
 \hline
 11872422329 \\
 - \quad 16 \quad 16 \quad 16 \quad 16 \\
 \hline
 12786313 \\
 \boxed{127863D_{16}}
 \end{array}$$

$$\begin{array}{r}
 \textcircled{12} \quad 1100011_2 \\
 + 1011011_2 \\
 \hline
 12111132 \\
 - \quad 2 \quad \quad \quad 22 \\
 \hline
 \boxed{1011110_2}
 \end{array}$$

$$\begin{array}{r}
 \textcircled{13} \quad \boxed{1001R1} \\
 101 \overline{) 101110} \\
 \underline{- 101} \quad \downarrow \downarrow \downarrow \\
 000100 \\
 \underline{- 101} \\
 001
 \end{array}$$

$$\begin{array}{r}
 \textcircled{14} \quad \overset{6}{7} \overset{2}{3} \overset{5+}{2} \overset{4}{5} \overset{3}{4} \overset{5+}{0}_8 \\
 - 164273_8 \\
 \hline
 \boxed{546245_8}
 \end{array}$$

$$\begin{array}{r}
 \textcircled{15} \quad \overset{8}{8} \overset{16+}{C} \overset{9}{4} \overset{16+}{0} \overset{16+}{A} \overset{16+}{3}_{16} \\
 - 231A79_{16} \\
 \hline
 6976210 \\
 \boxed{69762A_{16}}
 \end{array}$$

$$\begin{array}{r}
 \textcircled{16} \quad \overset{0}{1} \overset{1}{1} \overset{21}{0} 0 1 1_2 \\
 - \quad 0 1 0 1 1 0 1_2 \\
 \hline
 1 0 0 0 1 1 0_2
 \end{array}$$

$$\begin{array}{r}
 \textcircled{17} \quad 1 0 1 0 1 1 0 \\
 \times \quad 1 0 1 1 \\
 \hline
 1 0 1 0 1 1 0 \\
 1 0 1 0 1 1 0 \\
 0 0 0 0 0 0 0 \\
 + 1 0 1 0 1 1 0 \\
 \hline
 1 1 1 0 1 1 0 0 1 0_2
 \end{array}$$

$$\begin{array}{r}
 \textcircled{18} \quad 1 1 0 1 1 0 1_2 \\
 - \quad 1 0 0 1 0 1 0_2 \\
 \hline
 \end{array}$$

$\xrightarrow{\text{invert}} 1 1 1 1 1 1$
 $\xrightarrow{1's \text{ complement}} 0 1 1 0 1 0 1$
 $\xrightarrow{+} 1 1 0 1 1 0 1$
 $\xrightarrow{+} 0 1 1 0 1 0 1$
 $\xrightarrow{+} 1 0 1 0 0 0 1 0$
 $\xrightarrow{+} 1$
 $\xrightarrow{+} 0 1 0 0 0 1 1_2$ difference

$$\begin{array}{r}
 \textcircled{19} \quad 1 0 1 0 1 1 0_2 \\
 - \quad 1 0 1 0 0 0 1_2 \\
 \hline
 \end{array}$$

$\xrightarrow{\text{invert}} 1 1 1 1 1 1$
 $\xrightarrow{1's \text{ complement}} 0 1 0 1 1 1 0$
 $\xrightarrow{2's \text{ complement}} 0 1 0 1 1 1 1$
 $\xrightarrow{+} 1 0 1 0 1 1 0$
 $\xrightarrow{+} 0 1 0 1 1 1 1$
 $\xrightarrow{+} 1 0 0 0 0 1 0 1$ difference

(20)

$$\begin{array}{r}
 964805_{10} \\
 - 697123_{10} \\
 \hline
 \end{array}
 \xrightarrow[\text{9's complement}]{\text{invert}}
 \begin{array}{r}
 999999 \\
 - 697123 \\
 \hline
 302876
 \end{array}
 \rightarrow
 \begin{array}{r}
 \overset{1}{1} \overset{1}{1} \overset{1}{1} \\
 964805 \\
 + 302876 \\
 \hline
 1 \ 12 \ 6 \ 7 \ 14 \ 8 \ 11 \\
 - \quad 10 \quad 10 \quad 10 \\
 \hline
 \textcircled{1} \ 2 \ 6 \ 7 \ 6 \ 8 \ 1 \\
 + \quad \quad \quad 2 \ 1 \\
 \hline
 \text{difference} \quad \boxed{267682}
 \end{array}$$

(21)

$$\begin{array}{r}
 739618_{10} \\
 - 428561_{10} \\
 \hline
 \end{array}
 \xrightarrow[\text{9's complement}]{\text{invert}}
 \begin{array}{r}
 999999 \\
 - 428561 \\
 \hline
 571438 \\
 + \quad \quad \quad 1 \\
 \hline
 571439
 \end{array}
 \rightarrow
 \begin{array}{r}
 \overset{1}{1} \overset{1}{1} \overset{1}{1} \overset{1}{1} \overset{1}{1} \overset{1}{1} \\
 739618 \\
 + 571439 \\
 \hline
 1 \ 13 \ 11 \ 11 \ 10 \ 5 \ 17 \\
 - \quad 10 \ 10 \ 10 \ 10 \quad 10 \\
 \hline
 \textcircled{X} \ \boxed{311057} \\
 \text{difference}
 \end{array}$$