MATH 155 – Test 1

January 24, 2020 **Name:** Solution Set

Instructor: Patricia Wrean

Total: 30 points

1. (5 points) Convert the following numbers into the indicated base. You do not need to show any work.

   (a) 10111_2 to decimal

   23 (or 23_{10})

   $10111_2 = 1\times2^4 + 0 + 1\times2^2 + 1\times2^1 + 1\times2^0 = 16+4+2+1 = 23$

   (b) 210_8 to binary

   $10\ 001\ 000_2$ or $1000\ 1000_2$

   $210_8 = 010\ 001\ 000$

   (c) $3C_{16}$ to decimal

   60 (or 60_{10})

   $3C_{16} = 3\times16^1 + 12\times16^0 = 48+12 = 60$

   (d) 10_{10} to binary

   1010_2

   $10 = 8+2 = 1010_2$

   (e) 19_{10} to hexadecimal

   13_{16}

   $19 = 16+3 = 13_{16}$

(-1) each mistake

(-½) each missing non-decimal base on an otherwise correct answer

2. (1 point) Consider the number 465_n, where the base n is unknown. What values can n have?

   $n \geq 7$

   465_n

   base n must be larger than largest digit

   ↑

   6

3. (7 points) Convert the following numbers into the indicated base. Show your work.

(a) 942_{10} to octal

1656_8

	Q	R
$942 \div 8$	117	6
$117 \div 8$	14	5
$14 \div 8$	1	6
$1 \div 8$	0	1

3

(b) 4231_5 to decimal

566

$4231_5 = 4 \times 5^3 + 2 \times 5^2 + 3 \times 5 + 1$

$= 566$

2

(c) 2773_8 to hexadecimal

$5FB_{16}$

$2773_8 = 010\ 111\ 111\ 011$

$5 \quad F \quad B_{16}$

2

4. (1 point) Circle all statements below which are the negation of the statement "All of the lights are on."

   (a) None of the lights are on.

   (b) At least one of the lights is on.

   (c) At least one of the lights is off.

   (d) Not all of the lights are on.

   (e) Some of the lights are on.

   (f) All of the lights are off.

(+½) each correct answer circled

(−½) each incorrect answer circled

5. (2 points) Given the following information, answer the questions with "Yes", "No", or "Maybe".

   (a) Saryta programs in Python. Does she program in Python or Java?

   Yes / No / Maybe

   (b) Ming does not program in Python. Does he program in Python and Java?

   Yes / No / Maybe

at least one is true

both must be true

6. (3 points) Let p denote "I like milk in my tea." and q denote "I like sugar in my tea". Rewrite the following English sentences in terms of logical symbols (i.e. $p \wedge q$, $p \vee q$). Do not simplify!

   (a) I like milk in my tea or I don't like milk in my tea. $p \vee \bar{p}$

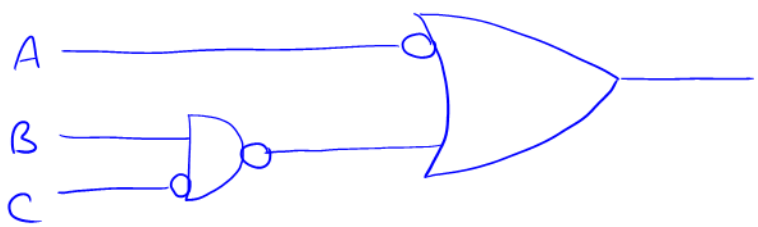
   (b) I like sugar but not milk in my tea. $q \wedge \bar{p}$

   (c) It is not true that I like both milk and sugar in my tea. $\overline{p \wedge q}$

$p \oplus \bar{p}$ } either

$p \wedge q$

7. (3 points) Draw the gate diagram that corresponds to the Boolean expression $\overline{A} + \overline{B\ \overline{C}}$. Do not simplify!



(−1) confuse "and" and "or"

(−1) incorrect order of operations

(−1) each incorrect negation

8. (4 points) Use a truth table to simplify the logical expression $(\overline{p} \wedge \overline{q}) \oplus (\overline{p} \wedge q)$.

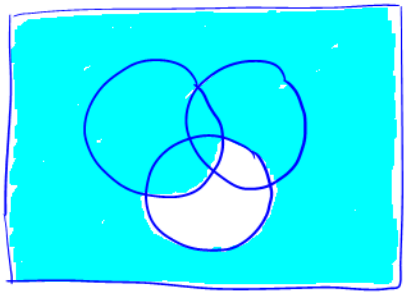
p	q	$\overline{p}$	$\overline{q}$	$\overline{p} \wedge \overline{q}$	$\overline{p} \wedge q$	$(\overline{p} \wedge \overline{q}) \oplus (\overline{p} \wedge q)$
0	0	1	1	1	0	1
0	1	1	0	0	1	1
1	0	0	1	0	0	0
1	1	0	0	0	0	0

same

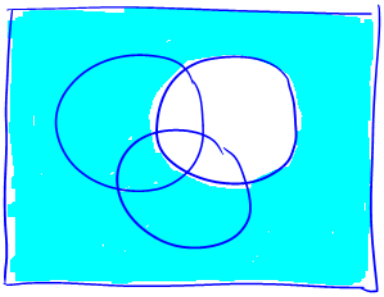
$\overline{p}$

(-1) no conclusion
(-½) each mistake for max of (-1) per column

9. (4 points) Represent $\overline{p \vee \overline{r} \vee \overline{q}}$ on the following Venn diagram by shading in the appropriate regions. Show intermediate steps on separate sketches and label them clearly to get full credit.

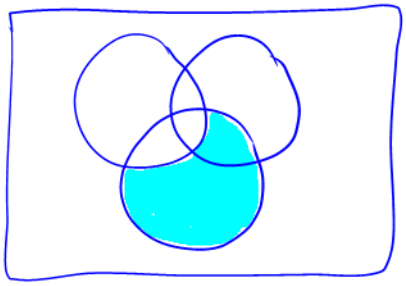


$p \vee \overline{r}$

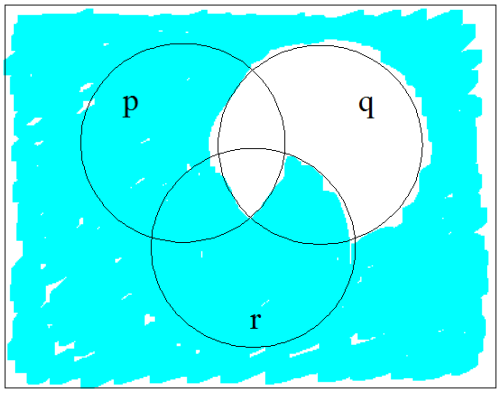


$\overline{q}$

(-½) each incorrect region to max (-1) per sketch
(-3) no work



$\overline{p \vee \overline{r}}$



$\overline{p \vee \overline{r}} \vee \overline{q}$