

Solution and Grading Policy for Midterm One

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1 Problem One

- (a): 66 (5 points);
- (b): 133705 (5 points); partial credit for the decimal value 47045 (2 points);

2 Problem Two

- (a): $3^2 \times 5^7$ or $0 - (3^2 \times 5^7 - 1)$ (5 points);
- (b): smallest: -2^9 or -512; largest: $2^9 - 1$ or 511; (5 points);

3 Problem Three

<i>a</i>	<i>b</i>	<i>Cin</i>	<i>Sum</i>	<i> Cout</i>
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Policy: 10 points if all correct, partial credit if a few of them are correct.

4 Problem Four

Policy: 10 points if all correct, partial credit in proportional to how many lines are correct.

```

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

```

5 Problem Five

$$17 = 000010001$$

$$12 = 000001100$$

(5 points)

$$-17 = 111101110$$

$$-12 = 111110011$$

(5 points)

$$\begin{array}{r}
111101110 \\
+ 111110011 \\
\hline
111100001 + 1 \\
= 111100010 \text{ (5 points)}
\end{array}$$

6 Problem Six

- Eight's complement: $8^n - x$ (5 points);
- x 's representation: 7777562 (5 points);
- $-x+y$: 7777647 (5 points);
- Note: partial credit if there is only a few wrong bits in the solution;

7 Problem Seven

- (a): 4 (5 points);
- (b): 3 (5 points);
- (c): 4 (5 points);
- (d): 6 (5 points);

8 Problem Eight

Proof: Let $x = q_x d + r_x$, $y = q_y d + r_y$ (5 points)

$$\begin{aligned} & (x \times y) \% d \\ &= [(q_x d + r_x) \times (q_y d + r_y)] \% d \\ &= (q_x q_y d^2 + q_x r_y d + q_y r_x d + r_x r_y) \% d \text{ (key step)} \\ &= (r_x r_y) \% d \\ &= (x \% d \times y \% d) \% d \text{ (5 points)} \end{aligned}$$