CS 173, Fall 17 Examlet 2, Part B

Name:____

NetID:____________________ **Lecture:** **A** **B**

Discussion: **Thursday** **Friday** **9** **10** **11** **12** **1** **2** **3** **4** **5** **6**

1. (5 points) Is the following claim true? Informally explain why it is, or give a concrete counter-example showing that it is not.

   Claim: For all non-zero integers a and b, if $a \mid b$ and $b \mid a$, then $a = b$.

2. (6 points) Use the Euclidean algorithm to compute $\gcd(2015, 837)$. Show your work.

3. (4 points) Check the (single) box that best characterizes each item.

   $0 \mid 0$ true ☐ false ☐

   Two positive integers p and q are relatively prime if and only if $\gcd(p, q) > 1$. true ☐ false ☐

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1. (5 points) Is the following claim true? Informally explain why it is, or give a concrete counter-example showing that it is not.

   Claim: For all positive integers a, b, and c, if $\gcd(a,b) = n$ and $\gcd(a,c) = p$, then $\gcd(a,bc) = np$.

2. (6 points) Use the Euclidean algorithm to compute $\gcd(1609, 563)$. Show your work.

3. (4 points) Check the (single) box that best characterizes each item.

   For any positive integers p and q, if $\text{lcm}(p,q) = pq$, then p and q are relatively prime. true ☐ false ☐

   $(5 \times 5) \equiv 1 \pmod 6$ true ☐ false ☐

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1. (5 points) Is the following claim true? Informally explain why it is, or give a concrete counter-example showing that it is not.

   Claim: For all positive integers a, b, and c, $\gcd(ca, cb) = c \cdot \gcd(a, b)$

2. (6 points) Use the Euclidean algorithm to compute $\gcd(2380, 391)$. Show your work.

3. (4 points) Check the (single) box that best characterizes each item.

   $25 \equiv 4 \pmod 7$ true ☐ false ☐

   Two positive integers p and q are relatively prime if and only if $\gcd(p, q) = 1$. true ☐ false ☐

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1. (5 points) Is the following claim true? Informally explain why it is, or give a concrete counter-example showing that it is not.

   For any positive integers a, b, and c, if $a \mid bc$, then $a \mid b$ or $a \mid c$

2. (6 points) Write pseudocode (iterative or recursive) for a function gcd(a,b) that implements the Euclidean algorithm. Assume both inputs are positive.

3. (4 points) Check the (single) box that best characterizes each item.

$2 \mid -4$	true ☐	false ☐
If a and b are positive and $r = \text{remainder}(a, b)$, then $\gcd(a, b) = \gcd(r, a)$	true ☐	false ☐

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1. (5 points) Explain how to use the Euclidean algorithm to test whether two positive integers p and q are relatively prime.

2. (6 points) Use the Euclidean algorithm to compute $\gcd(1702, 1221)$. Show your work.

3. (4 points) Check the (single) box that best characterizes each item.

If p, q, and k are primes, then $gcd(pq, qk) =$ — q ☐ — pq ☐ — pqk ☐ — $q\gcd(p,k)$ ☐

$29 \equiv 2 \pmod 9$ — true ☐ — false ☐

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1. (5 points) For any real numbers x and y, let's define the operation $\oslash$ by the equation $x \oslash y = x^2 + y^2$. Is the following claim true? Informally explain why it is, or give a concrete counter-example showing that it is not.

   Claim: For any real numbers x,y, and z, $(x \oslash y) \oslash z = x \oslash (y \oslash z)$

2. (6 points) Use the Euclidean algorithm to compute $\gcd(2737, 2040)$. Show your work.

3. (4 points) Check the (single) box that best characterizes each item.

   $\gcd(p, q) = \frac{pq}{\mathrm{lcm}(p, q)}$ (p and q positive integers) always ☐ sometimes ☐ never ☐

   $-3 \equiv 3 \pmod 4$ true ☐ false ☐