**1.**(1 pt)
Determine whether f is a function from $\mathbb{Z}$ to $\mathbb{R}$.
Enter "Y" for yes and "N" for no.

__ 1. $f(n) = \frac{1}{n^2-16}$
__ 2. $f(n) = \pm n$
__ 3. $f(n) = \sqrt{n^2+4}$
__ 4. $f(n) = 1/(n^2+6)$

**2.**(1 pt) Find the following values.
(a) $\lfloor 1.1 \rfloor$

(b) $\lceil 1.1 \rceil$

(c) $\lfloor -0.1 \rfloor$

(d) $\lceil -0.1 \rceil$

(e) $\lceil 2.99 \rceil$

(f) $\lceil -2.99 \rceil$

(g) $\lfloor \frac{1}{2} + \lceil \frac{1}{2} \rceil \rfloor$

(h) $\lceil \lfloor \frac{1}{2} \rfloor + \lceil \frac{1}{2} \rceil + \frac{1}{2} \rceil$

**3.**(1 pt)
Determine if each of the following functions from $\{a,b,c,d\}$ to itself is one-to-one and/or onto.
Check ALL correct answers.
(a) $f(a) = b, f(b) = a, f(c) = b, f(d) = c$

- A. one-to-one.
- B. onto.
- C. neither one-to-one nor onto.

$f(a) = d, f(b) = a, f(c) = c, f(d) = b$

- A. neither one-to-one nor onto.
- B. onto.
- C. one-to-one.

$f(a) = c, f(b) = d, f(c) = a$

- A. one-to-one.
- B. neither one-to-one nor onto.
- C. onto.

**4.**(1 pt) Given that $f(x) = 7x^2 + 1$ and $g(x) = 6x + 7$ are functions from $\mathbb{R}$ to $\mathbb{R}$, find
(a) $f \circ g$.

(b) $g \circ f$.

**5.**(1 pt) Find the number of bytes required to encode n bits of data where n equals:
(a) 4.
(b) 10.
(c) 500.
(d) 3000.

**6.**(1 pt)
Determine if each of the following functions is $O(x^2)$.
Answer Y for yes and N for no.

__ 1. $f(x) = x\log(x)$
__ 2. $f(x) = 2^x$
__ 3. $f(x) = \log(2^x)$
__ 4. $f(x) = \lfloor x \rfloor \cdot \lceil x \rceil$
__ 5. $f(x) = x^2 + 1000$
__ 6. $f(x) = \frac{x^4}{2}$
__ 7. $f(x) = 17x + 11$

**7.**(1 pt) Find the least integer n such that f(x) is $O(x^n)$ for each of the following functions:
(a) $f(x) = 2x^2 + x^8\log(x)$
(b) $f(x) = 3x^9 + (\log x)^4$
(c) $f(x) = \frac{x^4+x^2+1}{x^4+1}$
(d) $f(x) = \frac{x^3+5\log(x)}{x^4+1}$

**8.**(1 pt)
Check the answer that best describes the relationship between f(x) and x.
(For example if f(x) is $\Theta(x)$ check that as your answer and not $O(x)$ or $\Omega(x)$ even though these are true also in this case.)
(a) $f(x) = 10$ is

- A. $O(x)$
- B. $\Theta(x)$
- C. $\Omega(x)$

(b) $f(x) = 3x + 7$ is

- A. $O(x)$
- B. $\Omega(x)$
- C. $\Theta(x)$

(c) $f(x) = x^2 + x + 1$ is

- A. $\Theta(x)$
- B. $O(x)$
- C. $\Omega(x)$

(d) $f(x) = 5\log(x)$ is

- A. $\Theta(x)$
- B. $\Omega(x)$
- C. $O(x)$

(e) $f(x) = \lfloor x \rfloor$ is

- A. $\Omega(x)$
- B. $O(x)$
- C. $\Theta(x)$

**9.**(1 pt) In this problem it will be useful to recall the following properties of logarithms: $\log(xy) = \log(x) + \log(y)$ and $\log(x^a) = a\log(x)$.
Find the least integer k such that f(n) is $O(n^k)$ for each of the following functions:

(a) $f(n) = n\log(4^n)$ _____

(b) $f(n) = 1^8 + 2^8 + \cdots + n^8$ _____

(c) $f(n) = \log(n!)$ _____

(d) $f(n) = \frac{\log(n^n)}{n^5+1}$ _____