For the next 7 questions, select from the following four choices to describe the given function.

A. Neither onto nor one-to-one.

B. One-to-one, but not onto.

C. Onto, but not one-to-one.

D. One-to-one and onto.

1. $f : \{0,1\}^4 \to \{0,1\}^3$. $f(x)$ is obtained from x by removing the last bit. For example $f(0110) = 011$.

C

2. $f : \mathbb{Z} \to \mathbb{Z}$. $f(x) = \lceil \frac{x}{5} \rceil - 4$.

C

3. $f : \{0,1\}^3 \to \{0,1\}^3$. $f(x)$ is obtained from x by flipping every bit. For example $f(0110) = 1001$.

D

4. $f : \mathbb{Z} \to \mathbb{Z}$. $f(x) = 5x - 4$.

B

5. $f : \{0,1\}^3 \to \{0,1\}^4$. $f(x)$ is obtained from x by replacing the last bit with "00". For example $f(111) = 1100$.

A

6. $f : \mathbb{Z} \times \mathbb{Z} \to \mathbb{Z}$. $f(x,y) = x + y$.

C

7. $f : \mathbb{Z} \to \mathbb{Z}$. $f(x) = x - 4$.

D

Select the correct value for the following expressions:

8. $\lfloor -3.7 \rfloor =$

   A. -4 C. $-.7$

   B. 3.7 D. -3

9. $\lceil 5 \rceil =$

   A. -5 C. 5

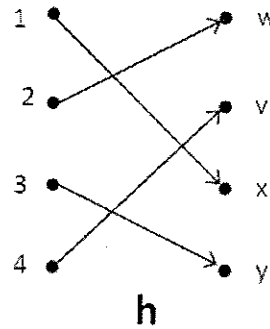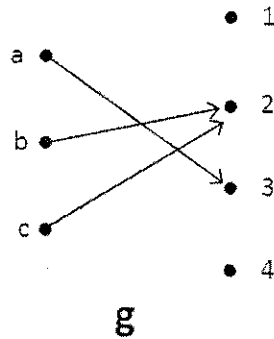   B. 6 D. 4

10. $\lfloor \frac{3}{2} + \lceil \frac{1}{3} \rceil \rfloor =$

   A. 3 C. $\frac{11}{6}$

   B. 2 D. 1

We will define two functions: $g : \{a,b,c\} \to \{1,2,3,4\}$ and $h : \{1,2,3,4\} \to \{w,v,x,y\}$. The functions are shown in the arrow diagrams below.

g

h

11. What is the range of g?

A. $\{a,b,c\}$

B. $\{1,2,3,4\}$

C. $\{1,4\}$

D. $\{2,3\}$

12. What is the domain of $h \circ g$?

A. $\{1,2,3,4\}$

B. $\{w,v,x,y\}$

C. $\{1,4\}$

D. $\{a,b,c\}$

13. What is $h^{-1}(y)$?

A. $\{1,2,3,4\}$

B. 3

C. y

D. $\{w,v,x\}$

14. What is the domain of $h^{-1} \circ h$?

A. $\{a,b,c\}$

B. $\{1,2,3,4\}$

C. $\{1,4\}$

D. $\{w,v,x,y\}$

15. What is $h \circ g(b)$?

A. 2

B. $\{w,v,x,y\}$

C. w

D. y

16. Which one of the choices below describes the function g?

A. Neither onto nor one-to-one.

B. One-to-one, but not onto.

C. Onto, but not one-to-one.

D. One-to-one and onto.

17. Which of the following statements is true?

A. g and h are both bijections.

B. g is a bijection, but h is not.

C. h is a bijection, but g is not.

D. Neither g nor h are bijections.