Math 46   Exam 1   Spring 2009   Name:_____
Open book, open notes, calculator allowed. Write your name on this exam, you must turn it in, but you will get it back! You may write on this exam. Write all answers on your scantron form.

(1) [Section 2.1] Set A = {1,2,3,4,5}. Set B = {3,6,9}. Set C = {6,7,8,9,10}. The Universe for this problem is U = {1,2,3,4,5,6,7,8,9,10}.
Which list shows the elements in $\overline{B} \cap \overline{C}$?
(A) {6,9}   (B) {1,2,3,4,5}   (C) {1,2,4,5}   (D) {3}

(2) In problem 1, how many elements in $A \cup B$?
(A) 8   (B) 7   (C) 6   (D) 5

(3) [Section 1.3 – "Gauss's trick"]. Find the sum 300 + 301 + 302 + … + 399 =
(A) 69,900   (B) 30,000   (C) 15,000   (D) 34,950

(4) [Take-away game] Suppose you play the following game with an opponent: you start with a pile of 100 bottle tops. Each of you may remove 1,2,3,4,5,6, or 7 bottle tops on each turn. The player who removes
the last bottle top is the winner.
Which player has a winning strategy?
(A) The first player   (B) The second player (C) Neither   (D) Both

(5) In the problem in (4), if the game begins with 190 bottle tops, then the first player has a winning strategy in which the first move is to take this number of bottle tops:
(A) 8   (B) 7   (C) 6   (D) 5

(6) $12 \equiv 2 \pmod{\_\_\_\_}$. Which of the following make this statement true, if the blank is filled with any number in the list?

(A) 3, 4, or 6   (B) 4 or 12   (C) 2, 5, or 10   (D) 2, 4, or 6

(7) (a) True or False? The prime numbers begin 1,2,3,5,7,9,11,…
(A) True   (B) False

(8) True or False? The Hamming code is a code that can not only detect errors, but actually correct them.
(A) True   (B) False

(9) True or False? Fibonacci was best known during his lifetime for discovering what is now known as the Fibonacci numbers or the Fibonacci sequence.
(A) True   (B) False

(10) True or False? The use of set theory in elementary school mathematics can be traced to the furor over the launching of the Russian satellite Sputnik.
(A) True   (B) False

(11) If 355 students are to go on a field trip in 10 buses, then the pigeonhole principle guarantees that at least one bus must have at least _____ students on it (what is the maximum number guaranteed?)
(A) 34   (B) 35   (C) 36   (D) 40

(12) Suppose that 7 different elements are selected at random from the set $\{1,2,3,4,7,8,9,10,11,12\}$. Which arrangement of numbers within boxes could be part of an explanation as to why some pair of the selected numbers will have a difference of 3?

(A) | 1 | | 3 | | 5 | | 7 | | 9 | | 11 |

(B) | 1,4, 7,10 | | 2,5, 8,11 | | 3,6, 9,12 |

(C) | 1,4 | | 2,5 | | 3,6 | | 4,7 | | 5,8 | | 6,9 |

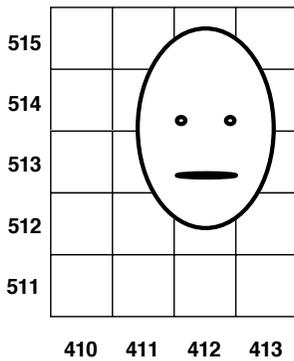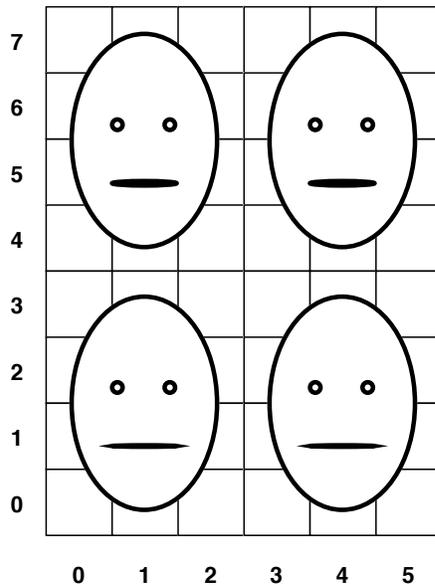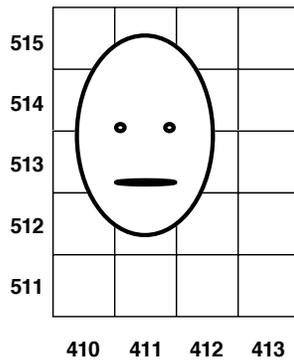(D) | 1,4 | | 2,5 | | 3,6 | | 7,10 | | 8,11 | | 9,12 |
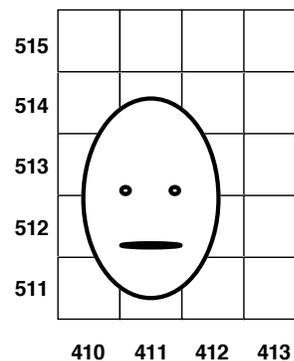
(13) If this pattern continues throughout the plane, which shows the correct placement of the face in the boxes below?
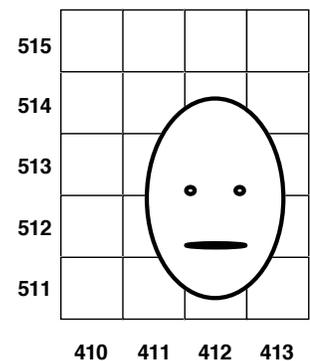

(A)

(B)

(C)

(D)
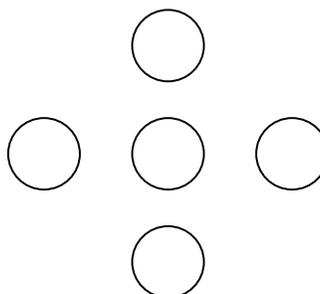
(14) Convert 1305_6 to base ten:
(A) 59   (B) 1305   (C) 239   (D) 329

(15) Convert 135_{10} to base two:
(A) 11100001   (B) 10000111   (C) 100011   (D) 101010101

(16) If the numbers 9,10, 11, 12, and 14 are placed in the circles, one number per circle, to make the sum across equal to the sum vertically, then the numbers which might appear in the center circle would be:
(A) 11
(B) 14
(C) 10 and 14
(D) 9 and 14

(17) Convert to the Indo-Arabic form number 2,022 to Roman numerals:
(A) MCMLXIII   (B) MMCCXX   (C) MMXXII   (D) MMCCII

(18) Which property is illustrated by this diagram?
(A) Associative property of multiplication
(B) Distributive property of multiplication over addition
(C) Commutative property of multiplication
(D) Commutative property of addition
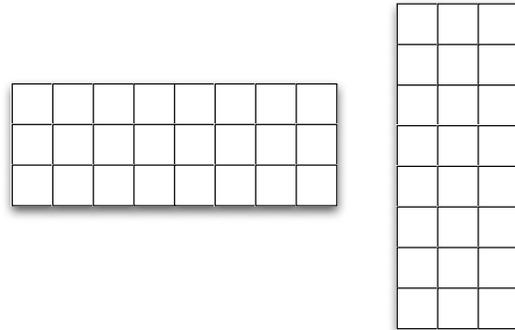
(19) [Section 2.2, Sets and logic]. A total of 70 people respond to a survey about whether they watch the two TV shows American Idol and the Colbert Report. 45 people in set A say that they watch American Idol, regardless of whether they also watch the Colbert Report. 40 people in set B say they watch the Colbert Report, regardless of whether they also watch American Idol. 20 say they watch both. How many watch neither?
(A) 5   (B) 10   (C) 15   (D) 20

(20) Logic.
On Monday Alex sold a printer to Bill for $80, Bill sold a phone to Cora for $70, and Cora sold an iPod to Alex for $60.
On Tuesday Bill sold the printer to Cora for $100, Cora sold the phone to Alex for $90, and Alex sold the iPod to Bill for $80 .
On Wednesday Cora sold the printer to Alex for $50, Alex sold the phone to Bill for $70, and Bill sold the iPod to Cora for $60.
At the end of the day on Wednesday, who had lost or made how much from these sales?
    (A) Alex made 20, Bill came out even, and Cora made 20
    (B) Alex made 30, Bill came out even, and Cora lost 30
    (C) Alex came out even, Bill made 30, and Cora lost 30
    (D) Alex made 10, Bill lost 10, and Cora came out even