

BONUS QUESTIONS

For credit on a bonus question turn in a written sheet with your name, course number, ID, and the solution - including your explanation. Deadline is April 8.

1. Determine the next number in the sequence: 7 8 5 3 9 8 1 6 3
3 9 7 4
2. Determine the next number in the sequence: 0 1 4 10 20 35

One question on the first Bonus set had to do with a magic trick done in class involving base 11. The next two tricks, which were done in class, also have to do with arithmetic in base n , for some n (a different n for each trick).

3. A magic trick done this semester asked someone to pick a number between 100 and 999 (not a palindromic number that reads the same forwards and backwards), then reverse the digits and subtract the smaller of the two numbers from the larger. Then turn to this page in The Complete Sherlock Holmes book, then take the last digit of the page and count down that many lines. Finally, give the first two words of the line. From this the magician is able to recite the entire sentence containing those two words. Give a full (mathematical) explanation of how this can be done, and also which number base is being used.
4. Still another magic trick done this semester had someone choose a number from 1 to 127, then look at a bunch of cards with numbers on them and say which cards had their number. The magician then told what the number is. Here are the numbers on each card, explain the trick and the number base that is being used.
First card 1,3,5,7,9,11,...,123,125,127 (all odd numbers from 1 to 127)
Second card 2,3,6,7,10,11,14,15,18,19,22,23,26,27,30,31,34,35,38,39,42,43,46,47,50,51,54,55,58,59, 62,63,66,67,70,71,74,75,78,79,82,83,86,87,90,91,94,95,98,99,102,103,106,107,110,111,114,115,118,119,122, 123,126,127
Third card 4-7,12-15,20-23,28-31,36-39,44-47,52-55,60-63,68-71,76-79,84-87,92-95,100-103,108-111, 116-119,124-127
Fourth card 8-15,24-31,40-47,56-63,72-79,88-95,104-111,120-127
Fifth card 16-31,48-63,80-95,112-127
Sixth card 32-63,96-127
Seventh card 64-127

5. One hundred wine tasters meet in a hotel in southern France for a convention. The owner of the hotel wants to see how good they are, so all 100 are seated at a table and blindfolded. The owner tells them “each of you has four glasses of wine in front of you, an 1890 Chardonnay, a

1900 Burgundy, a 1911 Chablis, and a 1932 Riesling. Your task is to identify them by tasting them.”

The results were as follows. No-one got all four wrong, i.e. every taster got at least one correct. The number that got exactly one correct was 50, and the number that got exactly two correct 25. The number that got all four correct was half the difference between 50 and twice the number that got exactly three correct.

Question: how many got exactly three correct? [Given on a scholarship examination for Oxford Univ.]

6. Calgary and Banff are 100 km distant. A train leaves Calgary towards Banff at 60 km/hr, and another train departs Banff at exactly the same time, headed towards Calgary at 40 km/hr. There is also a fly which can fly at 150 km/hr. It leaves the front tip of the Calgary train at the moment the train departs, flies to the tip of the train that had departed Banff, then flies back to the Calgary train, then back to the Banff train, etc., until it is crushed when the two trains unfortunately crash (the railroad controller had a hangover and had fallen asleep on the job).

Question : what was the total distance the fly travelled?

7. Beat your instructor in table tennis. A match can be arranged almost any Sunday on the 4th floor, Math Sci Bldg, usual time 13:00-16:00.