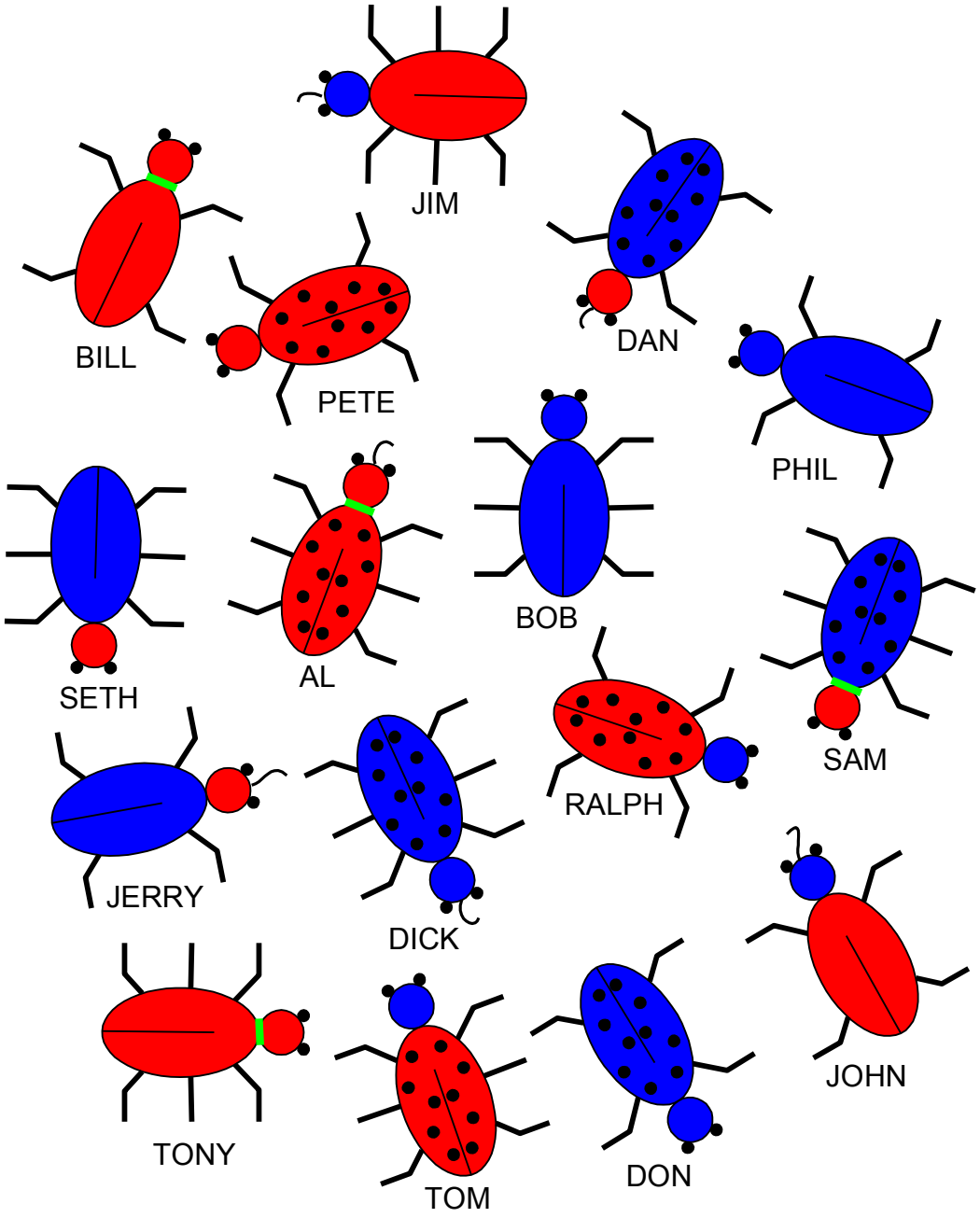
Problem Set 3

Problem 1. A friend thinks of one of the bugs below. You are to identify the one he's thinking of by asking questions about its appearance like, "Does it have spots?" What is your strategy to assure you'll always find the bug in just four questions?



Problem 2. In the game "Twenty Questions" (or "Animal, Mineral, Vegetable"), what is the best strategy for finding the answer. In 20 questions? Suppose you finally guess correctly on the twentieth question. How many possible patterns of 20 yes/no answers are there? Then if the number of things in the world is greater than that number, you can't always guess in 20 questions.

Problem 3. Choose the parity bit for the information bits given below so the parity is odd. (The block length is $2^4 = 16$ here). What is the decimal number corresponding to the i bits?

p_5	p_4	p_3	i_{10}	p_2	i_9	i_8	i_7	p_1	i_6	i_5	i_4	i_3	i_2	i_1	i_0
?	?	?	0	?	0	1	1	?	0	1	0	0	1	1	1

Problem 4. The block length of an error-correction code is 16 bits with odd parity. Find the errored bit in the received block below, and give the decimal number corresponding to the corrected code.

p_5	p_4	p_3	i_{10}	p_2	i_9	i_8	i_7	p_1	i_6	i_5	i_4	i_3	i_2	i_1	i_0
1	1	0	1	0	1	1	0	0	1	1	1	0	1	1	0

Problem 5. The highest parity bit (p_5 in Problems 3 and 4) is actually unnecessary. Show you can find the errored bit in Problem 4 without consulting p_5.

Change (error) p_5 in your answer to problem 3. Now you need p_5 to find the error, but there would be no error if there were no p_5.

Problem 6. For a block length of 2 ($n = 1$, so $2^n = 2$), what is the efficiency? What is the smallest block length that can correct an error in just one i bit?