

1. a) Suppose you wished to find a binary error-correcting code which correct up to 3 errors reliably. What is the minimum weight needed for this code? Explain.
- b) Now suppose you only needed to detect 3 errors. What is the minimum weight needed now?

2. Consider the following binary linear code with 3 digits + 3 check digits  
[Each row gives weights, and each weighted sum should be even.]

	$a_1$	$a_2$	$a_3$	$c_1$	$c_2$	$c_3$
a) Find the code for 011.	1	1	0	1	0	0
	0	1	1	0	1	0
	1	0	1	0	0	1

- b) A code is given as 100011. Assuming at most one error occurred, what was the original 3-digit number?

3. Construct an efficient binary code for the letters A, B, C, D where the frequencies are given by

Letter	Frequency
<i>A</i>	50%
<i>B</i>	25%
<i>C</i>	15%
<i>D</i>	10%

Translate ABACABAD into this code.

4. Convert 30 meters per second into miles per hour. [1 mile = 1609 meters].
5. A 180mm diameter circular silicon wafer can be used to produce 162 microprocessors. How many microprocessors do you expect can be made using a 300mm silicon wafer?

6. A 1 lb weight has a diameter of 2 in. What do you expect the diameter of an 8 lb weight to be if it is the same shape?

7. Which is a better deal, a 10 in pizza for \$6 or a 12 in pizza for \$8? Why?

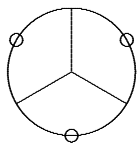
8. If a quantity A is 25% more than B, what percentage is B less than A?

- 1) 20%                      2) 25%                      3) 33%

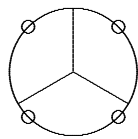
9. A scale model is made of an airplane that is one ninth the linear dimensions of the original. Assuming it is geometrically similar and made of the same materials, at what proportion of the speed of the original can it fly?

[Hint: (Pressure on wing)  $\propto$  (Speed)<sup>2</sup>.]

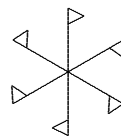
10. Give the symmetry type (e.g., d4, c5) for each of the following figures and draw on each diagram all lines of reflectional symmetry (if there are any).



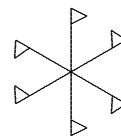
(a) \_\_\_\_\_



(b) \_\_\_\_\_



(c) \_\_\_\_\_



(d) \_\_\_\_\_

11. Which of the following symmetries does the following pattern have?

a) Reflection (draw line)                      Yes / No

b) Glide reflection (draw line)                      Yes / No

c) (Non-trivial) Rotation (mark center)                      Yes / No

