Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ID\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Group\_\_\_\_\_\_\_\_\_\_

**Part I:** (6 points) True (T) |False (F) questions. (1 point deduction for each wrong answer)

1. \_\_\_\_\_ The range of a homomorphism can be an empty set.
2. \_\_\_\_\_ Under a homomorphism, an image of any subset of the domain is a subspace of the range space.
3. \_\_\_\_\_ Under a linear map, the image of linearly independent set is linearly independent.
4. \_\_\_\_\_ The null space of a homomorphism must have at least one element.
5. \_\_\_\_\_ Under a linear map *h* from *V* to *W*. Given that *b*1,*b*2,…,*b*n form a basis of *V*, we can conclude that *h*(b1)*,*h(b2)*,…,*h(bn) span the range space.
6. \_\_\_\_\_ If the nullity of a linear map is 0, then the map is an isomorphism.

**Part II:** Answer the questions.

1. (2 points) Given a homomorphism *f*(*x,y,z,w*) = *x* + 2*y* + 3*z* + 4*w*. Describe its null space.
2. (2 points) Define a homomorphism to be .

What is the dimension of the codomain?

Write down a basis of the range space.