**Assignment Two**

**Question 1 (It is Question 7 in EXE\_vector)**

In the figure, *ABCDHEFG* is a prism with parallelogram *ABCD* as its base.

Chart, radar chart

Description automatically generated

**(a)** Show that

**(b)** It is given that the coordinates of the vertices are *B=*(4, 6, 0), *C=*(7, 12,1), *D=*(5, 8, 3) and *G=*(11, 12, 0).

**(i)** Find *CE* .

**(ii)** Find the coordinates of *E* and a unit vector in the same direction of *OE* .

**(10 marks)**

**Question 2 (It is Question 22 in EXE\_vector)**

Word count and word count histogram vectors. Suppose the -vector is the word count

vector associated with a document and a dictionary of words. For simplicity we will

assume that all words in the document appear in the dictionary.

(a) What is ?

(b) What does mean?

(c) Let be the -vector that gives the histogram of the word counts, i.e., is the

fraction of the words in the document that are word . Use vector notation to express

in terms of . (You can assume that the document contains at least one word.)

**(10 marks)**

**Question 3**

Let ;

For the following case, determine the set , with the conventional vector addition and scalar multiplication, fulfill the closure properties for the conventional vector addition and scalar multiplication.

**(10 marks)**

**Question 4 (**This a difficult question. The purpose of this question is to give you a real challenge in your university study. Do not ask any help. Try to solve it from the basic definition of vector space**. If you ask help from your classmates, me, or tutors, the purpose of this question becomes meaningless. I do not expect every student is able to solve it. If you can solve it by yourself, you are very good in the concept of linear algebra and your studying skill is in another level). Do not expect the answer is very complicated. The answer can be completed in a few lines of sentences.**

Let;. Define

where in the definition of , we use the conventional vector addition and scalar multiplication. Clearly, the conventional vector addition n does not have the closure property.

That is, “for any andin, is in ” is wrong.

Now you need to design a new operator, denoted as **,** such thatfor any andin, is in .

**Explain your answer.**

**(10 marks)**