# Advanced Methods in NLP – Assignment 1

1. **Question:** Prove that softmax is invariant to constant offset in the input, that is, for any input vector and any constant C,

Where means adding the constant C to every dimension of . Remember that

**Answer**: We will show that softmax is invariant to translation:

1. **See softmax.py**
2. **Question:** Derive the gradients of the sigmoid function and show that it can rewritten as a function value (i.e, in some expression where only , but not x, is present).

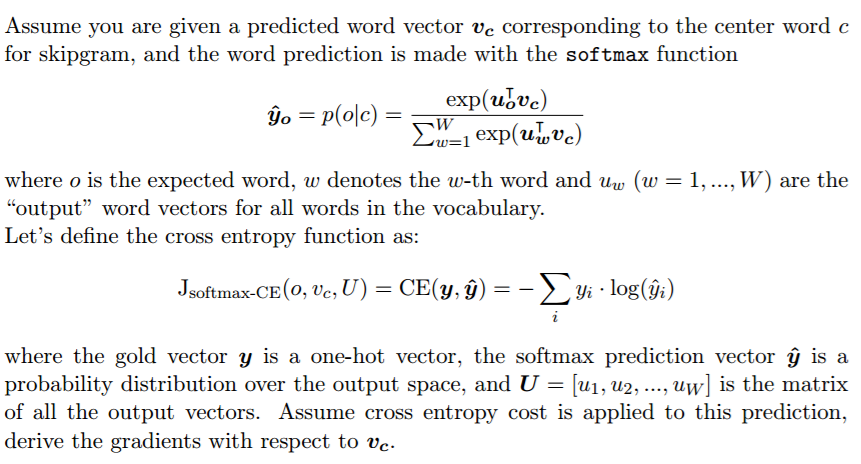
Assume that he input x is a scalar for this question.

Recall the sigmoid function is: .

**Answer:**

1. **See sigmoid.py**
2. **See gradcheck.py**

**Word2vec**

1. **Question:**  
   

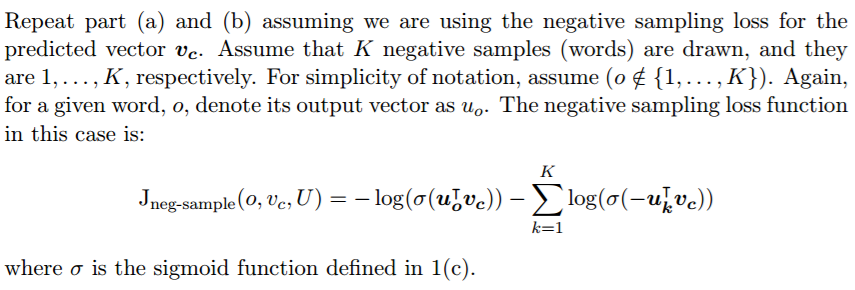
**Answer:**

The following is the gradients with respect to Vc.

1. **Question:**  
   

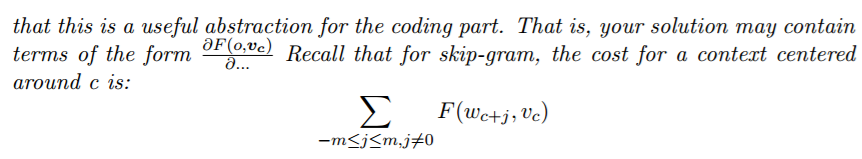
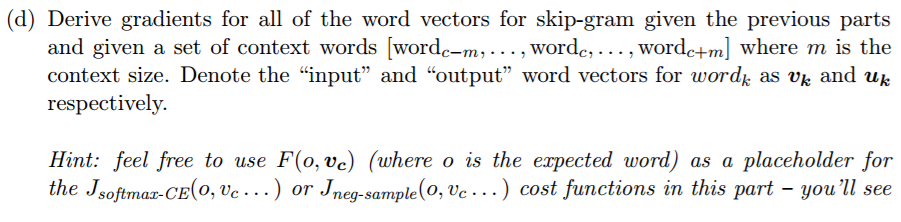
**Answer:**

* The gradients with respect to uw when w=o:
* The gradients with respect to uw when w≠o:

**Question:**  


**Answer:**

As we saw in 1.c: , therefore,

1. **Question:**  
   ****

**Answer:**

As we saw in the previous parts we will denote as a placeholder for the cost functions and and .

For skip-gram the gradients for the cost of one context window are:

1. **See word2vec.py**
2. **See sgd.py**
3. **See knn.py**
4. **See run.py**