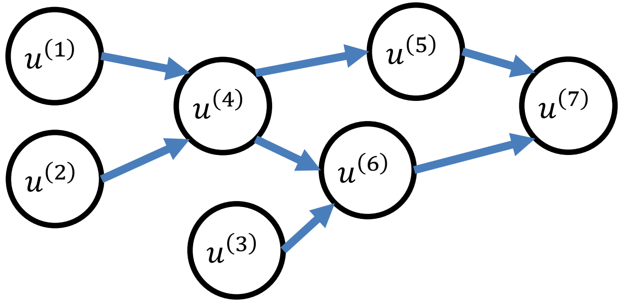
NC STATE UNIVERSITY

ECE542 - Quiz 2

Consider the computation graph on the right-top and the algorithm for backpropagation on the right-bottom.



Answer the following:

1. [3pts] What partial derivative does $GT\left[u^{(N)}\right]$ (line 2 of algorithm) represent?
2. [3pts] What partial derivative does $GT\left[u^{(j)}\right]$ present?
3. [4pts] Provide an expanded expression (with indices corresponding to the provided graph) for $GT\left[u^{(4)}\right]$ based on line 4 of the algorithm. E.g.,

$$GT\left[u^{(6)}\right] = GT\left[u^{(7)}\right] \cdot \frac{\partial u^{(7)}}{\partial u^{(6)}}\left(u^{(5)}, u^{(6)}\right)$$

	Algorithm – Back-Propagation
1	Run Forward Propagation
2	$GT\left[u^{(N)}\right] \leftarrow 1$
3	**for** $j = N - 1$ down to 1 **do**
4	$GT\left[u^{(j)}\right] \leftarrow \sum_{i:j \in Pa(u^{(i)})} GT\left[u^{(i)}\right] \cdot \frac{\partial u^{(i)}}{\partial u^{(j)}}\left(Pa\left(u^{(i)}\right)\right)$
5	**end for**
6	**Return** $\left\{GT\left[u^{(i)}\right]\right\}_{i=1}^{N_I}$

1. $\frac{\partial u^{(7)}}{\partial u^{(7)}}$

2. $\frac{\partial u^{(7)}}{\partial u^{(j)}}$

3. $GT\left[u^{(5)}\right] \cdot \frac{\partial u^{(5)}}{\partial u^{(4)}}\left(u^{(4)}\right) + GT\left[u^{(6)}\right] \cdot \frac{\partial u^{(6)}}{\partial u^{(4)}}\left(u^{(3)}, u^{(4)}\right)$