# CIS 467/667: Introduction to Articial Intelligence Homework 1

## PROBLEM 1

a $\sum_{n=0}^{D} x^n =$

$$= \frac{1 - x^D}{1 - x}$$

b $\sum_{n=0}^{\infty} x^n =$

$$= \frac{1}{1 - x}$$

c $\sum_{n=0}^{D} nx^{n-1}$

$$= \frac{d}{dx} \sum_{n=0}^{D} x^n = \frac{d}{dx}(\frac{1 - x^D}{1 - x})$$

$$= \frac{1 - x^n}{(1 - x)^2} - \frac{nx^{n-1}}{1 - x}$$

d $\sum_{n=0}^{\infty} nx^{n-1}$

$$= \frac{d}{dx} \sum_{n=0}^{\infty} x^n = \frac{d}{dx}(\frac{1}{1 - x})$$

$$= \frac{1}{(1 - x)^2}$$

e $\sum_{n=0}^{\infty} nx^n$

*Multiply option 'd' with 'x'*

$$= \frac{x}{(1 - x)^2}$$

f $\sum_{n=0}^{\infty} n(n-1)x^{n-2}$

$$= \frac{d}{dx} \sum_{n=0}^{\infty} nx(n-1)$$

$$= \frac{d}{dx} \frac{1}{(1 - x)^2}$$

$$= \frac{2}{(1 - x)^3}$$

g $\sum_{n=0}^{\infty} (n+2)(n+1)x^n$

*multiply option (b) with* $x^2$ *and differentiate* 2 *times*

$$= \frac{d}{dx} \frac{d}{dx} (\frac{x^2}{1 - x})$$

$$= \frac{2}{(1 - x)^3}$$

h $\sum_{n=0}^{\infty}(n^2+2n+2)x^n$

*consider option 'g' − option'e'*

$$= \sum_{n=0}^{\infty}(n+2)(n+1)x^n - \sum_{n=0}^{\infty} nx^n$$

$$=$$

i $\sum_{n=0}^{\infty}(n+1)^2x^n$

*consider option 'h' − option 'c'*

$$= \sum_{n=0}^{\infty}(n^2+2n+2)x^n - \sum_{n=0}^{\infty} x^n$$

$$= \frac{1+x}{(1-x)^3}$$