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Horribly incomplete, and most likely wrong, but I was not prepared and not awake enough to finish this in the time I gave myself. Not an excuse, just an explanation as to why my work is subpar this assignment. My next assignment should better indicate the quality of work I can produce.

Question 1:

a)

$$\sum_{i=1}^{n+1} \frac{(i-1)^2}{i * n}$$
$$= \sum_{i=1}^{n+1} \frac{(j)^2}{n(j+1)}$$

b)

$$\sum_{i=3}^n \frac{j+1}{j+n}$$

Question 3:

a)

$$\frac{4!}{3!}$$
$$= \frac{4 * 3 * 2 * 1}{3 * 2 * 1}$$
$$= \frac{4}{1}$$
$$= 4$$

b)

$$\frac{3!}{0!}$$
$$= \frac{3 * 2 * 1}{1}$$
$$= \frac{3 * 2}{1}$$
$$= 6$$

c)

$$\frac{(n-1)!}{(n+1)!}$$
$$= \frac{(n-1) \dots}{(n+1)(n)(n-1) \dots}$$
$$= \frac{1}{n(n+1)}$$

d)

$$\frac{n!}{(n-k+1)!}$$

$$= \prod_{i=0}^k$$

Question 4:

d)

$$\sum_{i=1}^n i(i!) = (n+1)! - 1$$

$$\sum_{i=1}^1 1(1!) = (1+1)! - 1$$

$$\sum_{i=1}^1 1 = 1$$

Then we can assume that given the case of one,  $n = k$ .

$$\begin{aligned} \sum_{i=1}^{k+1} i(i!) &= \sum_{i=1}^k i(i!) + (k+1)(k+1)! \\ &= (k+1)! - 1 + (k+1)(k+1)! \\ &= (1+k+1)(k+1)! - 1 \\ &= (k+2)(k+1)! - 1 \\ &= (k+2)! - 1 \end{aligned}$$

Therefore  $k \rightarrow k+1$  and  $n=1$  and  $n=k$  and  $k \rightarrow k+1$  then  $n$  is valid for any positive integer