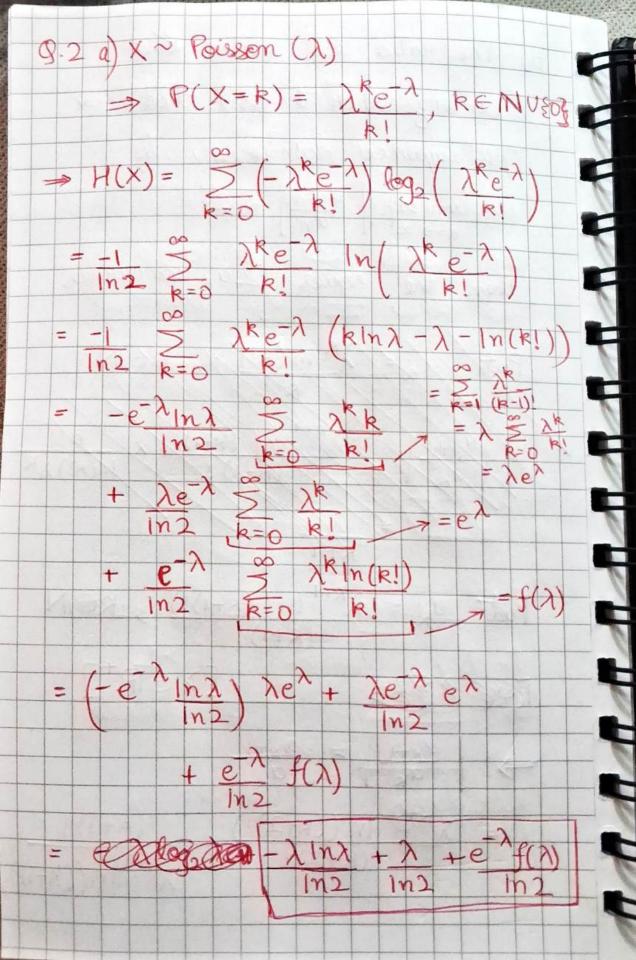
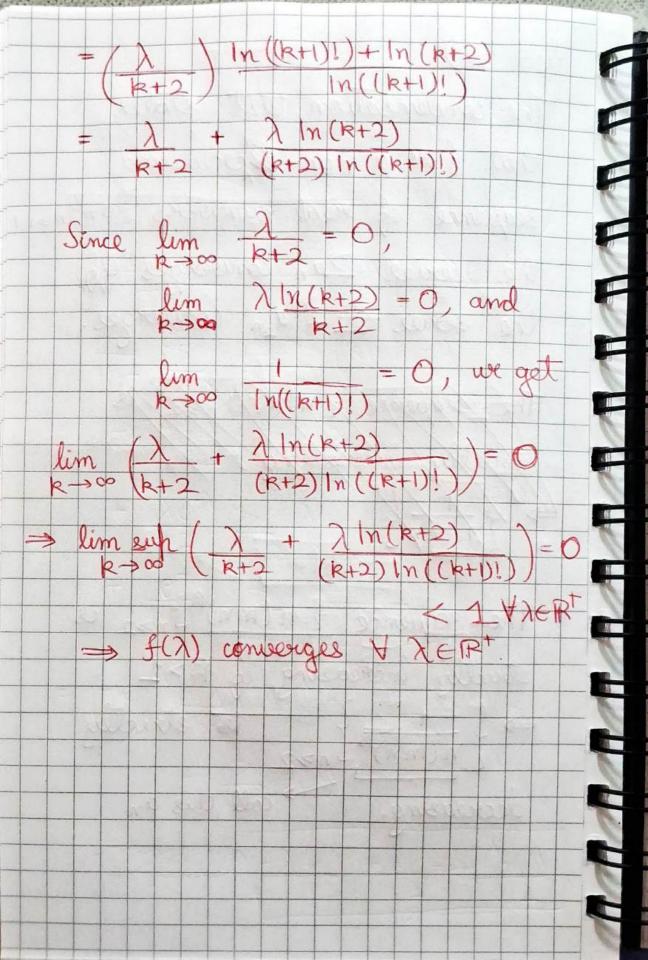
Information Theory Assignment 1 9.1 X ~ Geometric (p) >> P(X=R)= (1-h)k-1h, REN. $\Rightarrow H(X) = \sum_{x \in supp X} (-p(x) \log_2 p(x))$ $= -\frac{1}{2} (1-\mu)^{k-1} \mu \log_2(1-\mu)^{k-1} \mu$ = - $\sum_{k=1}^{\infty} (1-h)^{k-1} h [(k-1) \log_2 (1-h) + \log_2 h]$ = $(-\mu \log_2(1-\mu))$ $\sum_{k=1}^{\infty} (k-1)(1-\mu)^{k-1}$ + (- p log_2 p) = (1-p) k-1 $S = (1-h) + 2(1-h)^{2} + ...$ $(1-h)S = (1-h)^{2} + ...$ $hS = (1-h) + (1-h)^{2} + ...$ = 1-h => S= 1-h

 \Rightarrow $H(x) = (-h \log_2(1-h))(1-h)$ + (-hlogoh)(h) $= -(1-h)\log_2(1-h) - \log_2 h$ $-(1-h)\log_2(1-h)-h\log_2 h$ = H2(h) { h + 0 } is given } Answers assuming supp X = NV & 03 P(x=k)= (1-h)kh, k ENU {0} will also be accepted. The entropy is anyways going to be the same since it depends only on the hmg.

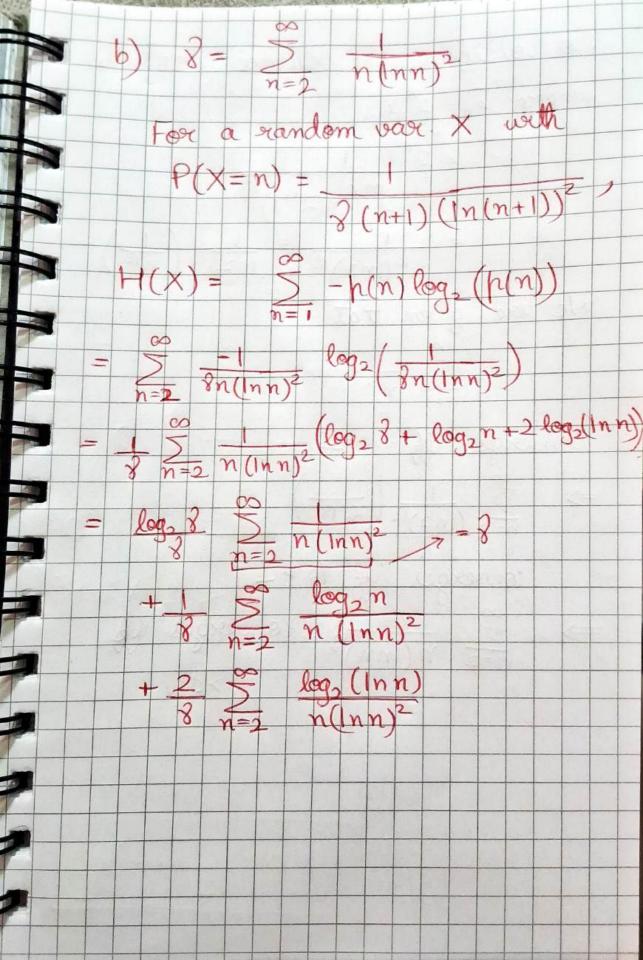


The ratio test states b) (among other things) that for a sequence Ean3n=1, $\lim_{n\to\infty} \sup \left| \frac{a_{n+1}}{a_n} \right| < 1$ then the series I an converges an = Ik In (kly REN tal (kut!) (ktt) Put a_R = λ^{R+1} In ((R+1)!), REN (k+1)! [XERT] art = art $\frac{a_{R}}{\lambda^{R+2}} \ln ((R+2)!) \times \frac{(R+1)!}{\lambda^{R+1}}$



The condensation test states that for a non- thereasing sequence of real numbers \(\frac{2}{3} \angle 1 > 1) the series Zan converges is the series > 2n an converges. The sequence & n/n n/3 n/2 structly increasing The sequence & n (mn) B3 n>2 is structly increasing if B>1 > Shully
n(Inn)B n>2 is structly decreasing. call this an

So consider the sequence & bn 3n=> where $b_n = 2^n a_{2n}$ $= 2^n 1$ 2 (In(2n))B $= \frac{1}{n^{3}(1n2)^{3}} = \frac{1}{(1n2)^{3}}$ We are given that Nal na converges iff x>1 $\Rightarrow \sum_{n=2}^{\infty} (\ln 2)^n \left(\frac{1}{n^n} \right)$ converges if B>1 == n(Inn)B converges iff B>1



of $\log_2 n$ = 1 ∞ $n(\ln n)^2$ $\ln 2$ n=2 $n(\ln n)$ ich we know dwerges, to $+\infty$.

There, all but finitely many n of the sequence Now see that which we know diverges, to + ∞. Further, all but finitely many terms of the sequence abre negative

The series

log_2 (In n)

n=2 n (Inn)² either converges or diserges to +00. In any case, H(X) diverges to +00. 9.4 Easily programmed. I get 9.71626 bits/word. Exercise of ± 10-4 will be tolerated.

8.5 A succinct & clear proof has been given in Cover and Thomas, on pages 59 and 60. (theorem 3.1.2)