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CSCI-UA 310-001 PS1

1.

a. $\lim_{n\to\infty} \frac{n(\log_2 n)^2}{n^2 \log_2 n} \to \lim_{n\to\infty} \frac{\log_2 n}{n} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{\frac{1}{nln(2)}}{1} \to \frac{1}{nln(2)} \to$ D.S. = $\frac{1}{\infty} = 0$ $\to$ This implies that g grows faster than f and **f=o(g)**

b. $\lim_{n\to\infty} \frac{n^2}{n(\log_2 n)} \to \lim_{n\to\infty} \frac{n}{(\log_2 n)} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{1}{\frac{1}{nln(2)}} \to nln(2) \to$ D.S. = ∞ $\to$ This implies that f grows faster than g and **g=o(f)**

c. $\lim_{n\to\infty} \frac{n(\log_2 n)^4}{n^{1.2}} \to \lim_{n\to\infty} \frac{(\log_2 n)^4}{n^{.2}} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \lim_{n\to\infty} \frac{4(\log_2 n)^3}{.2n^{.2}ln(2)} \to$ L'Hopital $\to$ $\lim_{n\to\infty} \frac{12(\log_2 n)^2}{.2n^{.2}ln(2)ln(2).2} \to$ L'Hopital $\to \lim_{n\to\infty} \frac{24(\log_2 n)}{.2n^{.2}ln(2)ln(2).2ln(2).2} \to$ L'Hopital $\to$ $\lim_{n\to\infty} \frac{24}{.2n^{.2}ln(2)ln(2).2ln(2).2ln(2).2} \to$ D.S. = 0 $\to$ This implies that g grows faster than f and **f=o(g)**

d. $\lim_{n\to\infty} \frac{200n^2+n^{1.5}}{(1/500)n^2} \to \lim_{n\to\infty} \frac{200n+n^{.5}}{(1/500)n} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{200 + .5/n^{.5}}{(1/500)} \to$ D.S. = $\frac{200+0}{(1/500)} = 200 * 500 = 100000 \to$ This implies that f grows at the same rate as g and **f = θ(g)**

e. $\lim_{n\to\infty} \frac{\log_7 n}{\log_5 n} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{\frac{1}{nln(7)}}{\frac{1}{nln(5)}} \to \frac{nln(5)}{nln(7)} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to$ $\frac{ln(5)}{ln(7)} \to$ This implies that f grows at the same rate as g and **f = θ(g)**

f. $\lim_{n\to\infty} \frac{n(\log_2 n)^{-1}}{n^{.5}\log_2 n} \to \lim_{n\to\infty} \frac{n^{.5}}{(\log_2 n)^2} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{.5n^{.5}ln(2)}{2\log_2 n} \to$ D.S. = $\frac{\infty}{\infty} \to$ L'Hopital $\to \frac{.5ln(2)}{2}\frac{n^{.5}}{\log_2 n} \to \frac{.5ln(2)}{2}\frac{.5/n^{.5}}{1/nln(2)} \to \frac{.5^2 ln(2)^2}{2}\frac{n}{n^{.5}} \to \frac{.5^2 ln(2)^2}{2}n^{.5} \to$D.S. $\to \infty \to$ This implies that f grows faster than g and **g=o(f)**

g. $\lim_{n\to\infty} \frac{5^n}{7^n} \to \lim_{n\to\infty} (\frac{5}{7})^n \to \lim_{n\to\infty} e^{nln(\frac{5}{7})} \to \lim_{n\to\infty} e^{n(-0.336472237)} \to \lim_{n\to\infty} 1/e^{n(0.336472237)} \to$ D.S. = 0 $\to$ This implies that g grows faster than f and **f=o(g)**

h. $\lim_{n\to\infty} \frac{7^n}{5^{(n^2)}} \to \lim_{n\to\infty} (\frac{7}{5^n})^n \to$ D.S. = $(\frac{7}{\infty})^\infty \to (0)^\infty = 0 \to$This implies that g grows faster than f and **f=o(g)**

i. $\lim_{n\to\infty} \frac{n!}{(n+1)!} \to \lim_{n\to\infty} \frac{1}{(n+1)} \to$ D.S. = $\frac{1}{\infty} = 0 \to$ This implies that g grows faster than f and **f=o(g)**

j. $\lim_{n\to\infty} \frac{n}{2n+(-1)^n n^{.5}} \to$ Divide all terms by n $\to \lim_{n\to\infty} \frac{1}{2+(-1)^n n^{-.5}} \to (-1)^n n^{-.5} = 0$ as n$\to \infty$. Therefore, $\lim_{n\to\infty}$ = ½ $\to$ This implies that f grows at the same rate as g and **f = θ(g)**