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~~$p \wedge (p \vee \bar{p})$~~

$(q \wedge r) \vee (p \wedge \bar{q})$

$(q \wedge r) \wedge (p \vee \bar{p})$

$\underbrace{((q \wedge r) \wedge p)}_{6} \vee \underbrace{((q \wedge r) \wedge \bar{p})}_{7}$

$(p \wedge \bar{q})$

$(p \wedge \bar{q}) \wedge (p \vee \bar{p})$

$[((p \wedge \bar{q}) \wedge p) \vee ((p \wedge \bar{q}) \wedge \bar{p})$

1 0 1   1 00

4   5

$\therefore U = \{4, 5, 6, 7\}$

PCNF convertion

convert given proposition to CNF notation include all missing max terms in the f^n proposition to convert it to PCNF

recurrence relation :-

A] Homogeneous linear recurrence relation

If the characteristic eq^n $ax^2 + bx + c = 0$ has 2 roots s_1 & s_2 then

a] If $s_1 \neq s_2$ then the formula for finding sequences $a_n = u s_1^n + v s_1^n$ where u & v are constants

If the roots are equal $s_1 = s_2$ then formula for finding sequences $a_n = (u + vn) s^n$

If the characteristic eq^n is of the form $ax^3 + bx^2 + cx + d = 0$ then and roots are s_1, s_2, s_3 then If $s_1 = s_2 = s_3$ then sequences given by $a_n = (u + vn + wn^2) s^n$ u, v, w are constan

If $s_1 = s_2 = s$ & $s \neq s_3$ sequences given by
$a_n = (u + vn)s^n + ws_3^n$ whe
If $s_1 \neq s_2 \neq s_3$ ten sequn is given by
$a_n = us_1^n + vs_2^n + ws_3^n$

Determin the sequn whose relation is given by
$c_n = 3c_{n-1} - 2c_{n-2}$ with initial condn
where $c_1 = 5$, $c_2 = 3$

$c_n = 3c_{n-1} - 2c_{n-2}$

$c_n - 3c_{n-1} + 2c_{n-2} = 0$ $\quad c_n = x$

$x^2 - 3x + 2 = 0$

$x = 2, 1$

$s_1 \neq s_2$

$a_n = us_1^n + vs_2^n$ —— (A)

$a_n = u(1)^n + v(2)^n$

$n = 1$

$a_1 = u(1)^1 + v(2)^1$

$5 = u + v(2)$ —— (I)

$n = 2$

$a_2 = u(1)^2 + v(2)^2$

$3 = u + 4v$ —— II

$v = -1$ $\quad u = 7$

by putting in eqn (A)

$a_n = 7 - 2^n$

$a_1 = 7 - 2^1 = 5$

$a_2 = 7 - 2^2 = 3$

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determin the seq^n whose relation is given by
$a_n = 2a_{n-1} - a_{n-2}$ $a_1 = 1.5$ $a_2 = 3$

→

$a_n - 2a_{n-1} + a_{n-2} = 0$

$x^2 - 2x + 1 = 0$

$x = 1, 1$

$s_1 = s_2$

$a_n = (u + vn)s^n = us^n + vns^n$ — A

$a_1 = u + v$ $\quad\quad$ $a_2 = u + 2v$

$1.5 = u + v$ $\quad\quad$ $u + 2v = 3$

$u + v = 1.5$

$u + 2v = 3$

$\cancel{u} + 2v = 3$

$\cancel{u} + v = 1.5$

$v = 1.5$

$u = 0$

$a_n = 3/2\, n$

Non Homogenous linear recurrence relation

determine the sequence a_n whose recurrence relation is $a_n = a_{n-1} + 3$ with the initial cond^n $a_1 = 2$

→ $a_n = a_{n-1} + 3$

$= (a_{n-1-1} + 3) + 3$

$= (a_{n-2} + 3) + 3$

$= (a_{n-2-1} + 3) + 3 + 3$

$= a_{n-3} + 3 + 3 + 3$

$= a_{n-(n-1)} + 3(n-1)$ $\quad\quad$ $a_1 = 3$

$= a_1 + 3(n-1)$ $\quad\quad$ $a_2 = 5$

$a_3 = 8$

determine sequence B_n whose relation is given by $b_n = 2b_{n-1} + 1$ with initial condⁿ

$b_1 = 7$

$b_n = 2b_{n-1} + 1$

$b_n = 2b_{n-1-1} + 1$

$= 2(2b_{n-2} + 1) + 1$

$= 2(2[2b_{n-3} + 1] + 1] + 1$

$= \cancel{2(2[2(2b_{n-4}+1] + 1] + 1] + 1}$

$= \cancel{2(2}$

$= 2^3 b_{n-3} + 2^2 + 2 + 1$

$2^{n-1} b_{n-(n-1)} + 2^{n-2} + 2^{n-3} \ldots 2 + 1$

$b_1 = 2^{n-1} b_1 + 2^{n-2} + 2^{n-3} + 2 + 1$

$= 2^{n-1} 7 + (1 + 2 + \ldots + 2^{n-2} + 2^{n-3})$

$= 2^{n-1} 7 + \left(\frac{2^{n-1} - 1}{2 - 1}\right)$

$b_n = 7, 15 + (28 + 3) (31)$

$7, 15, 31 \ldots$

Procedure for particular solⁿ of general solⁿ for certain fⁿ $f(n)$ check right side of eqⁿ to have polynomials in n, powers of n and constant. the form of corresponding particular solⁿ would be as follows.

forms of f_n	Forms of $(a_n)^P$ to be assumed
constant	A, a constant
n	$nA_0 + A_1$
n^2	$n^2 A_0 + nA_1 + A_2$
n^t	$n^t A_0 + n^{t-1} A_1 - - A_t$
r^n $r \neq 1$	$A r^n$

total sol^n to the recurrence relation is given by
$a_n = a_n^{(H)} + a_n^{(P)}$

Solve the recurrence relation to find particular sol^n $a_r - a_{r-1} - 6a_{r-2} = -30$ where $a_0 = 20$, $a_1 = -5$

$\longrightarrow$

$a_r - a_{r-1} - 6a_{r-2} = -30$

$x^2 - x - 6 = 0$

$x = 3, -2$

$s_1 \neq s_2$

$-6x^2$, $-3 \;\; 2$, $-x$

$a_n = a_n^{(H)} + a_n^{(P)}$

$a_n = u s_1^n + v s_2^n$

$a_n = u(3)^n + v(-2)^n$

$n = 0$

$a_0 = u(3)^0 + v(-2)^0$

$a_0 = u + v$

$a_1 = u(3)^1 + v(-2)^1$

$a_1 = 3u - 2v$

$u + v = 20$

$3u - 2v = -5$

$+$

$-2u + 3v = 25$

$v = 7 \quad u =$

constant in right hand side some place terms by p. $r, r-1, r-2 = p$

~~p~~ $p - 6p = -30$

$-6p = -30$

$p = 5$

$a_n = u(-2)^n + v(3)^n + 5$

$n = 0$

$a_0 = u(-2)^0 + v(3)^0 + 5$

$a_0 = u + v + 5$

$20 - 5 = u + v$

$u + v = 15$

$n = 1$

$a_1 = u(-2)^1 + v(3)^1 + 5$

$-5 = -2u + 3v + 5$

$-2u + 3v = -10$

$$\begin{aligned} \cancel{2u} + 2v &= 30 \\ + \quad \cancel{-2u} + 3v &= -10 \\ \hline 5v &= 20 \end{aligned}$$

$\boxed{v = 4}$

$2u + 2(8) = 30$

$2u + 16 = 30$

$2u = 30 - 16$

$2u = 14$

$\boxed{u = 11}$

$a_0 = 11(-2)^0 + 4(3)^0 + 5$

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find the sol^n for recurrence relation

$a_0 = 1 \quad a_1 = 2 \quad a_n - 7a_{n-1} + 10a_{n-2} = 6+8n$

find S_1 & S_2

$x^2 - 7x + 10 = 0$

$x = 5, 2$

$a_n = nA_0 + A_1$

$a_{n-1} = (n-1)A_0 + A_1$

$a_{n-2} = (n-2)A_0 + A_1$

$(nA_0 + A_1) - 7((n-1)A_0 + A_1) + 10((n-2)A_0 + A_1) = 6+8n$

$nA_0 + A_1 - 7(n-1)A_0 - 7A_1 + 10(n-2)A_0) + 10A_1 = 6+8n$

$nA_0 + A_1 - 7nA_0 + 7A_0 - 7A_1 + 10nA_0 - 20A_0 + 10A_1$

$4A_1 + 4nA_0 - 13A_0 = 6+8n$

$8\cancel{n} = 4\cancel{n}A_0$

$\boxed{A_0 = 2}$

$6 = -13A_0 + 4A_1$

$6 = -13(2) + 4A_1$

$6 = -26 + 4A_1$

$32 = 4A_1$

$\boxed{A_1 = 8}$

$a_n = nA_0 + A_1$

$\boxed{a_n = 2n + 8}$

$a_n = u(S_1)^n + v(S_2)^n + 2n + 8$

$a_n = u(5)^n + v(2)^n + 2n + 8$

$n=0$

$a_0 = u + v + 8$

$1 = u + v + 8$

$\boxed{u + v = -7}$ — I

$n = 1$

$a_1 = u(5) + 2v + 10$

$2 = 5u + 2v + 10$

$\boxed{5u + 2v = -8}$ — II

$2u + \cancel{2v} = -14$

$-5u + \cancel{2v} = -8$

$-3u = -6$

$\boxed{u = 2}$

$5(2) + 2v = -8$

$2v = -8 - 10$

$2v = -18$

$\boxed{v = -9}$

If RHS is exponential form generating f^n