Expt. No. ~~[illegible]~~ 1.3 Reg. No.

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1) $\binom{6}{2}$ ab ~~ba~~ db ~~bd~~ ec ~~ce~~ fc ~~cf~~ ~~ff~~ ~~bb~~
ca ~~ac~~ dc ~~cd~~ ed ~~de~~ fd ~~df~~ ~~ee~~ ~~aa~~
cb ~~bc~~ ea ~~ae~~ ~~fa~~ ~~af~~ fe ~~ef~~ ~~dd~~
~~da~~ ~~ad~~ eb ~~be~~ ~~fb~~ ~~bf~~ ~~f~~ ~~dc~~

2) $\binom{12}{5}$ 3) ~~[illegible]~~ 210 792 91 3003

Recurrence Relation = Gives a relation regarding how a_n relates to its predecessor's

Ex: Fibonacci Sequence

~~General~~

~~First order~~ First order

$$a_n = ca_{n-1} + f(n)$$

If $f(n) = 0$ Homogeneous

$f(n) \neq 0$ Non-homogeneous

First order $a_n = c^n a_0$

$a_n = c^n a_0$

$a_n = 4^n 3$

Ex: $a_{n+1} = 4a_n$ for $n \geq 0$, $a_0 = 3$

$c = 4$ ~~$a_0 = 3$~~

Given $a_{n+1} = 4a_n$ —(1)

General solution $a_n = c^n a_0$ —(2)

If $a_n = c^n$ then $a_{n+1} = c^{n+1}$ —(3)

By (1) (3) $4a_n = c^{n+1}$

$4\cancel{c^n} = \cancel{c^n} \times c$

$\boxed{4 = c}$

Put c in (3) $a_n = 4^n 3$

(1) $a_n = 7a_{n-1}$ where $n \geq 1$ & $a_2 = 98$

$c = 7$

$a_2 = 7^2 \times a_0$

$a_0 = \frac{98}{49} = 2$

$a_n = 7^n \cdot 2$

$a_2 = c^2 \times a_0$

$98 = 49 \times a_0$

$a_0 = 2$

(2) $a_0 = 1000$

$a_n = a_n + 0.005a_n = 1.005a_n$

$c = \frac{6\%}{12} = 0.005$

$a_n = c^n a_0$

$a_n = (1.005)^n 1000$

$a_{12} = (1.005)^{12} 1000 = 1061.677\ldots$

(1) $a_{n+1} = 5a_n$ $a_0 = 2$

$a_{n+1} = (-3)\cdot a_n$ $a_0 = 6$ $n \geq 1$

$\frac{14}{5} \times 7$

$a_n = \frac{2}{5} a_{n-1}$

(2) $a_{n+1} = 1.5a_n$

$a_n = \left(\frac{5}{4}\right)^n a_{n-1}$

$a_{n+1} = 1.5^n a_n$

$a_{n+1} = \left(\frac{4}{3}\right)^n a_0$ $a_1 = 5 = \frac{4}{3} a_0$

$= \cancel{\frac{4}{3} \times \frac{15}{4}}$ ← $\frac{15}{4}$

$= \left(\frac{4}{3}\right)^n \times \frac{15}{4}$

$a_n = \frac{3a_{n-1}}{2}$

$= \left(\frac{3}{2}\right)^n 16$

$81 = \left(\frac{3}{2}\right)^4 a_0$

$a_0 = 16$

(3) $a_{n+1} = da_n$ $a_3 = 153/49$ $a_5 = 1377/2401$

$a_3 = c^3 a_0$

$153 = 49a_0c^3$ —(1) $1377 = 2401c^5 a_0$ —(2)

$\frac{153 = 49 a_0 c^3}{1377 = 2401 a_0 c^5}$

$c^2 = \frac{9}{49}$ $c = \frac{3}{7}$

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(5) ~~18/4~~ $c = \frac{6\%}{4} = \frac{0.06}{4} = 0.015$

$200 = 100 \times (1.015)^n$

$a_0 = 100$ $a_n = 200$

$2 = (1.015)^n$

$n = 47$

$47 \times 3 = 141$ months

(6) $c = \frac{8\%}{4} = 0.02$ $a_{15} = 7218.27$ $c = 1.02$

$7218.27 = (1.02)^{15} \times a_0$

$5363.28 = a_0$

$7218.27 = (1.32)^{15} \times a_0$

$a_0 = 112.156$

Second order

Case 1: Roots are distinct & real $a_n = Ak_1^n + Bk_2^n$

Case 2: Roots are equal & real $a_n = (A+Bn)k^n$

Case 3: Roots are imaginary $p \pm iq$ $a_n = r^n (A\cos n\theta + B\sin n\theta)$

$\theta = \tan^{-1}(q/p)$ $r = \sqrt{p^2+q^2}$

(1) (a) ~~$k_1 = 6$~~ $k_2 = 4$

~~$a_n = A3^n + B2^n$~~

~~$a_0 = 1 = A3 + B2$~~

~~$a_1 = 3 = A3 + B2$~~

~~$A = 1$ $B = 0$~~

(b) $k_1 = 5$ $k_2 = \frac{1}{2}$

$a_0 = 2 = A + B$

$a_1 = -16 = 10A + \frac{1}{2}B$

$A = -2$ $B = 4$

$n+2-n$

(1) $a_{n+2} + a_n = 0 \quad n \geq 0 \quad a_0 = 0 \quad a_1 = 3$

$\binom{5}{2,1,2}$

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

$(n-1)^3$

$n^3 - 1 \div 3(n)(n)$

$3n(n+1)$

$-3n^2 + 3n$

$k^2 + 0k + 1 = 0$

$k = 1i + 0, 0 - 1i$

$r = \sqrt{1^2 + 0^2} = \sqrt{1} = 1 \qquad \theta = \tan^{-1}(q/p) = \tan^{-1}\infty = 90°$

$a_n = r^n (A \cos n\theta + B \sin n\theta)$.

$a_0 = 1^0 (A \cos 0° + B \sin 0°) = 1(A \times 1 + B \times 0) = A$

$\boxed{0 = A}$

$-(3)(-n)(1)$

$-3n(n+2)$

$a_1 = 1^{(1)} (A \cos 90° + B \sin 90°) = 1(A \times 0 + B \times 1) = B \qquad -3n^2 - 6n$

$\boxed{3 = B}$

$\binom{16}{2,3,2,5,4} \; (2)^3 (-3)^2 (2)$

$a_n = r^n (\overset{0 \times 2}{0 \cos n\theta} + 3 \sin n\theta)$

$= 3 \sin n\theta$

(2) $a_n + 5a_{n-1} + 5a_{n-2} = 0 \quad a_0 = 0 \quad a_1 = 2\sqrt{5}$

$k^2 + 5k + 5 = 0$

$k = \frac{-5+\sqrt{5}}{2}, \frac{-5-\sqrt{5}}{2}$

$a_n = 2\left(\frac{-5+\sqrt{5}}{2}\right)^n - 2\left(\frac{-5-\sqrt{5}}{2}\right)^n$

Case 1

$a_n = A k_1^n + B k_2^n$

$a_0 = A + B = 0$

$a_1 = A\left(\frac{-5+\sqrt{5}}{2}\right) + B\left(\frac{-5-\sqrt{5}}{2}\right)$

$A = 2$

$B = -2$

$A = -16.944 \quad B = 16.944$

$\frac{2.118}{2\sqrt{5}} \qquad \frac{2.118}{2\sqrt{5}}$

Unit 1

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Ex 1.1 & 1.2

$P = \frac{n!}{(n-r)!}$

If repetition is allowed then pow...

1 a) $8+5 = 13$

b) $8 \times 5 = 40$

c) Rule of sum Rule of product

2 $5 \times 5 \times 5 \times 5 \times 5 \times 5 = 30$

3. a) $4 \times 12 \times 3 \times 2$

b) $4 \times 1 \times 3 \times 2$

4 a) $P(10,4)$

~~b) i) P(10,3) ii) P(10, 3~~

~~iii) P(10,3) × P(9,2) × P(8,1)~~

b) i) $3 \times 9 \times 8 \times 7$

ii) ~~3×9×8×7~~ $(3 \times 7 \times 6 \times 5) \times 4$

iii) No $= 7 \times 6 \times 5 \times 4$ All $= 10 \times 9 \times 8 \times 7$ $5040 - 840 = 4200$

5 C/G 0/Q 7 0-9 0-9 3/8

$2 \times 2 \times 10 \times 10 \times 10 \times 2$

6. a) $\frac{30!}{(30-8)!}$ b) $30-2 = 28$ $8-2=6$ $\frac{28!}{(28-6)!} \times 3!$

A B C

8 a) $12!$

b) $4 \times 3 \times 2 \times 1 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

c) $4! \times 5! \times 3!$

9 a) $8+6 = 14$ Total beverage $= 12$

$14 \times 12 =$ _____ ways

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~~b. (14) x 4 x 6 x 6~~ coffee tea

~~c. 8 x 6 x 6 x 1 x((14 x 4 3 x 2)~~

b. Coffee = 4 x 3 = 12 Tea = 6 x 3 = 18

(14) x 12 x 6 x 18

c. 8 x (6x3) x 6 x (3x1) x [[14 x (4x3)] x 2]

10. a) 4 x 3 = 12 c 12 + 2 = 14

b) 14 x 14

c) 14 x 13

13 a) 8! b) a) 7! b) 6!

15 4! e ? e ? e ? e ? e

17 1) Network = 7 local = 24 0/1 the no/:

$(2^7 - 2)(2^{24} - 2)$

22 3, 4, 4, 5, 5, 6, 7

5000000?

5 ___ ___ ___ 6 ___ ___ ___ 7 ___ ___ ___

6!/2! + 6!/2!x2! + 6!/2!x2!

Add all these

25 a) $P(n,2) = 90$ b) $P(n,3) = 3P(n,2)$

$\frac{n!}{(n-2)!} = 90$ $\frac{\cancel{n!}}{(n-3)!} = 3 \times \frac{\cancel{n!}}{(n-2)!}$

$\frac{n \times (n-1) \times \cancel{(n-2)!}}{\cancel{(n-2)!}} = 90$ $\frac{(n-2)\cancel{(n-3)!}}{\cancel{(n-3)!}} = 3$

$n^2 - n = 90$ $n - 2 = 3$

$\boxed{n = 10}$ $\boxed{n = 5}$

1. $2P(n,2) + 50 = P(2n, 2)$

$$2\times \frac{n!}{(n-2)!} + 50 = \frac{2n!}{(2n-2)!}$$

$$\frac{2n!}{(n-2)!} + 50 = \frac{2n!}{2(n-2)!} \qquad \frac{2\times n!}{2\times (n-2)!}$$

$$50 = n! - 2n!$$

$$50 = n!(1-2)$$

$$-50 = n!$$

$$\frac{2\times n!}{(n-2)!} + 50 = \frac{2n!}{(2n-2)!}$$

$$\frac{2\times n\times(n-1)\times\cancel{(n-2)!}}{\cancel{(n-2)!}} + 50 = \frac{2n\times(2n-1)\times\cancel{(2n-2)!}}{\cancel{(2n-2)!}}$$

$$2(n^2-n)+50 = 4n^2-2n$$

$$2n^2 - \cancel{2n} + 50 = 4n^2 - \cancel{2n}$$

$$50 = 2n^2$$

$$25 = n^2$$

$$\boxed{n = 5}$$

Binomial = $\sum_{k=1}^{n}\binom{n}{k} x^k y^{n-k}$

Multinomial = $\frac{n!}{n_1!\, n_2! \dots n_t!}$

Combination = $\frac{n!}{r!(n-r)!}$ or $^{n}C_{r}$.

52 cards

Suits: 4 Diamond, 4 heart, 4 club, 4 spades

4 Diamond → 13 cards

Combinations with repetition = $\binom{n+r-1}{r}$

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

n = distinct
r = repetition

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First Order

Non homogeneous

$a_0 = 2$

$$a_n = c^n a_0 + \sum_{k=1}^{n} c^{n-k} f(k)$$

Given $a_n - 3a_{n-1} = 5 \times 7^n$

$$a_n = 3a_{n-1} + 5 \times 7^n$$

$$= 3^n (a_0) + \sum_{k=1}^{n} 3^{n-k} (5 \times 7^n)$$

$$= 3^n (2) + 3^{n-1} \times 5 \times 7^1 + 3^{n-2} \times 5 \times 7^2 +$$

$$3^{n-3} \times 5 \times 7^3 + \cdots$$

$$= 3^n (2) + \frac{3^n}{3} \times 5 \times 7^1 + \frac{3^n}{3^2} \times 5 \times 7^2 + \cdots$$

$$= 3^n (2) + 3^n \times 5 \left(\frac{7}{3}\right) + 3^n \times 5 \left(\frac{7}{3}\right)^2 + \cdots$$

$$= 3^n (2) + 3^n \times 5 \left[\frac{7}{3} + \left(\frac{7}{3}\right)^2 + \left(\frac{7}{3}\right)^3 + \cdots\right]$$

$r = \frac{7}{3}$ $a = 7/3$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$\frac{7^n - 3^n}{3^n}$$

$$= 3^n (2) + 3^n \times 5 \left[\frac{\left(\frac{7}{3}\right)\left(\left(\frac{7}{3}\right)^n - 1\right)}{\frac{7}{3} - 1}\right]$$

$$= 3^n (2) + 3^n \times 5 \left[\frac{7/3 \left((7/3)^n - 1\right)}{4/3}\right]$$

$$3^n (2) + 35 \frac{(7^n - 3^n)}{4}$$

$$= 3^n (2) + 3^n \left(\frac{35}{4}\right)\left(\left(\frac{7}{3}\right)^n - 1\right)$$

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1) $a_n - 3a_{n-1} = 5(3^n)$ $\quad a_0 = 2$

$= c^n a_0 + \sum_{i=1}^{n} f(n)\, c^{n-i}$

$a_n = 3^n a_{n-1} + 3^{n-1} \times 5 \times 3^1 + 3^{n-2} \times 5 \times 3^2 + 3^{n-3} \times 5 \times 3^3 + \ldots$

$= 3^n (2) + \left[\frac{3^n}{\cancel{3}} \times 5 \times \cancel{3} + \frac{3^n}{\cancel{3^2}} \times 5 \times \cancel{3^2} + \frac{3^n}{\cancel{3^3}} \times 5 \times \cancel{3^3} + \ldots \right.$

$= 3^n (2) + \left[3^n \times 5 + 3^n \times 5 + 3^n \times 5 \right]$

$a = 3^n \times 5 \quad d =$

$3^n \times 5 \left[1 + 1 + 1 + \ldots n \right]$

$= 3^n (2) + n \times 3^n \times 5$

$= 3^n (2 + 5n)$

Tower of Hanoi

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

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

$a_n - 2a_{n-1} = 1$ $\quad a_0 = 0$

$a_n = c^n a_0 + \sum_{i=1}^{n} c^{n-i} f(n)$

$= 2^n (0) + \left[2^{n-1}(1) + 2^{n-2}(1) + 2^{n-3}(1) + \ldots \right]$

$= \left[\frac{2^n}{2} + \frac{2^n}{2^2} + \frac{2^n}{2^3} + \ldots \right]$

$= 2^n \left[\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \ldots \right]$ $\qquad \frac{a[r^n - 1]}{r - 1}$

$a = 1/2 \quad r = 1/2$

$= 2^n \left[\frac{1/2 [1/2^n - 1]}{1/2 - 1} \right]$ $\qquad \frac{1/2}{\frac{1-2}{2}}; 1/2$

$= 2^n \left[-[1/2^n - 1] \right] = 2^n \left[-1/2^n + 1 \right]$

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$= -\frac{\cancel{2^n}}{\cancel{2^n}} + 2^n$

$= -1 + 2^n$

$= 2^n - 1$

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Generating function

(1) 1, 1, 1, 1, 1 . . . . .

$1\times x^0 + 1\times x^1 + 1\times x^2 + 1\times x^3 + 1\times x^4 \ldots$

$1 + x + x^2 + x^3 + x^4 + x^5 \ldots$

$a = 1 \quad r = x \quad = \frac{a}{1-x}$

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

GP (1) $S_\infty = \frac{a}{1-r}$

(2) $S_n = \frac{a(1-r^n)}{1-r} \quad r<1$

(or)

$\frac{a(r^n-1)}{r-1} \quad (r>1)$

(2) 1, 2, 3, 4, 5 ......

$1\times x^0 + 2\times x^1 + 3\times x^2 \ldots$

$1 + 2x + 3x^2 + 4x^3 + 5x^4 \ldots$

$S_x = 1 + 2x + 3x^2 + \ldots \quad -(1)$

$x S_x = 0 + x + 2x^2 + 3x^3 + \ldots \quad -(2)$

$S_x - x S_x = 1 - 0 + x + x^2 + \ldots$

$S_x(1-x) = 1 + x + x^2 + \ldots$

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

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

(3) 1, 0, −1, 0, 1, 0, −1 ......

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

$= 1 + 0 - x^2 + 0 + x^4 + 0 - x^6$

$= 1 - x^2 + x^4 - x^6$

$a = 1 \quad r = -x^2 \quad = \frac{1}{1+x^2}$

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$G(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3$

$a_{n+1} - a_n = 3^n \qquad a_0 = 1$

$a_{n+1} = a_n + 3^n$

$a_{n+1} \times x^{n+1} = a_n \times x^{n+1} + 3^n \times x^{n+1}$

$\sum_0^\infty a_{n+1} x^{n+1} = \sum_0^\infty a_n x^{n+1} + \sum_0^\infty 3^n x^{n+1}$

$a_1 x^1 + a_2 x^2 + a_3 x^3 \ldots = a_0 x^1 + a_1 x^2 + a_2 x^3 + \ldots + 3^0 x^1 + 3^1 x^2 + \ldots$

$G(x) - a_0 = \cancel{G(x)} + x(a_0 + a_1 x + a_2 x^2 + \ldots) + 3^0 x^1 + 3^1 x^2 + \ldots$

$G(x) - a_0 = x(Gx) + 3^0 x^1 + 3^1 x^2 + \ldots$

$G(x) - x G(x) = a_0 + 3^0 x^1 + 3^1 x^2 + \ldots$

$G(x)(1-x) = 1 + x + 3x^2 + 3x^3 + 3x^4 \ldots$

$= \cancel{1+}$

$\cancel{S_x = 1 + x + 3x^2 + 3x^3 + 3x^4}$ $\cancel{S_x = 1 + 3x + 3x^2 \ldots}$

$\cancel{x S_x = x + x^2 + 3x^3 + 3x^4}$ $\cancel{x S_x = x + 3x^2}$

$\cancel{S_x - x S_x = 1 + 2x^2 + x^3 + x^4 \ldots}$ $\cancel{S_x(1-x) = 1 + 2x + x}$

$\cancel{S_x(1-x) =}$

$= 1 + x(3^0 1 + 3^1 x + 3^2 x^2 + 3^3 x^3 + \ldots)$

$= 1 + x \quad (1) + 3x + (3x)^2 + (3x)^3 + \ldots$

$3^0 x^0$

a

$\frac{a}{1-x} \qquad \frac{1}{1-3x}$

$S_x = 1 + 3x + 3x^2 + 3x^3 \ldots$

$x S_x = x + 3x^2 + 3x^3 + 3x^4 \ldots$

$S_x - x S_x = 1 + 2x + 0 + 0 + \ldots$

$S_x(1-x) = 1 + 2x$

$S_x = \frac{1+2x}{1-x}$

$\cancel{= 1 + x\left(\frac{1+2x}{1-x}\right)}$

$\cancel{= 1 + \frac{x + 2x^2}{1-x}}$

$\cancel{= \frac{1 - x + x + 2x^2}{1-x} = \frac{1+2x^2}{1-x}}$

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$$G(x)(1-x) = 1 + x\,(\underbrace{1 + 3x + 3x^2 + 3x^3 + \ldots\ldots}_{\downarrow})$$

$$= 1 + x$$

$$3^0x^0 + 3^1x^1 + 3^2x^2$$

$$a = 3^0x^0 = 1 \qquad r = 3x$$

$$\therefore \frac{a}{1-r} = \frac{1}{1-3x}$$

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

$$= \frac{1-3x+x}{1-3x}$$

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

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

$$\frac{1-2x}{(1-3x)(1-x)} = \frac{A}{(1-3x)} + \frac{B}{(1-x)}$$

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

$$\frac{1-2x}{\cancel{(1-3x)(1-x)}} = \frac{A - Ax + B - 3Bx}{\cancel{(1-3x)(1-x)}}$$

$$A - Ax + B - 3Bx = 1 - 2x$$

$$A + B - Ax - 3Bx = 1 - 2x$$

$$A + B = 1 \qquad -Ax - 3Bx = -2x$$

$$Ax + 3Bx = 2x$$

$$A + 3B = 2$$

$$\cancel{A} + B = 1$$

$$-\cancel{A} + 3B = 2$$

$$-2B = -1$$

$$B = \frac{-1}{-2} = \frac{1}{2}$$

$$A + B = 1$$

$$A = 1 - B$$

$$A = 1 - \frac{1}{2} = \frac{2-1}{2} = \frac{1}{2}$$

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$$= \frac{1}{2}\left[\frac{1}{1-3x} + \frac{1}{1-x}\right]$$

$$= \frac{a}{1-r} \qquad a=1 \quad r=3x \qquad a=1 \quad r=x$$

$$= \frac{1}{2}\left[(1+3x+(3x)^2+\dots+3^n x^n) + (1+x+x^2+\dots x\right.$$

$$= \frac{1}{2}(3n+1)$$

$$a_n = \frac{3^n+1}{2}$$

(3) $a_{n+2} - 3a_{n+1} + 2a_n = 0 \qquad a_0 = 1 \quad a_1 = 6$

$$\sum_0^\infty a_{n+2}x^{n+2} - \sum_0^\infty 3a_{n+1} \sum_0^\infty x^{n+2} + \sum_0^\infty 2a_n x^{n+2} = 0$$

$$a_2x^2 + a_3x^3 + a_4x^4 \dots - [3a_1x^2 + 3a_2x^3 + 3a_3x^4 + \dots] + [2a_0x^2 + 2a_1x^3 + 2a_2x^4\dots$$

$$[G(x) - a_0 - a_1x] - 3x[a_1x + a_2x^2 + a_3x^3 + \dots] + 2x^2[a_0 + a_1x + a_2x^2 \dots]$$

$$[G(x) - a_0 - a_1x] - 3x[G(x) - a_0] + 2x^2[G(x)] = 0$$

$$G(x) - a_0 - a_1x - 3xG(x) + 3xa_0 + 2x^2G(x) = 0$$

$$G(x) - 3xG(x) + 2x^2G(x) - a_0 - a_1x + 3xa_0 = 0$$

$$G(x)(1-3x+2x^2) - 1 - 6x + 3x = 0$$

$$G(x)(1-3x+2x^2) = 1 + 6x - 3x$$

$$G(x) = \frac{1+6x-3x}{1-3x+2x^2}$$

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

$$1-3x+2x^2$$

$$2x^2-3x+1$$

$$\cancel{2x(x-1)}$$

$$2x^2-2x-x+1$$

$$2x(x-1)-1(x-1)$$

$$(x-1)(2x-1)$$

B,

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$$\frac{1+3x}{(x-1)(2x-1)} = \frac{A}{(x-1)} + \frac{B}{(2x-1)}$$

$$2xA - A + Bx - B = 1+3x$$

$$-A - B + 2xA + Bx = 1+3x$$

$$-A - B = 1 \qquad 2A + B = 3$$

$$-A - B = 1$$
$$+\ 2A + B = 3$$
$$\boxed{A = 4}$$

$$-4 - B = 1$$
$$-B = 5$$
$$\boxed{B = -5}$$

$$\cancel{1+3x} =$$

$$= \frac{4}{(x-1)} - \frac{5}{(2x-1)}$$

$$= 4\left(\frac{1}{x-1}\right) - 5\left(\frac{1}{2x-1}\right)$$

Multiply by $-$,

$$= -4\left(\frac{1}{1-x}\right) + 5\left(\frac{1}{1-2x}\right)$$

$a=1 \quad r=x \qquad a=1 \quad r=2x$

$$= -4(1+x+x^2+x^3 \ldots x^n) + 5(1+2x+(2x)^2+(2x)^3+\ldots$$

$$= -4 + 5 \cdot 2^n$$

$$a_n = 5(2^n) - 4$$

(3) $a_{n+2} - 2a_{n+1} + a_n = 2^n \quad n \geq 0 \quad a_0 = 1 \quad a_1 = 2$

$$\sum_0^\infty a_{n+2} x^{n+2} - \sum_0^\infty 2a_{n+1} x^{n+2} + \sum_0^\infty a_n x^{n+2} = \sum 2^n x^{n+2}$$

$$(a_2x^2 + a_3x^3 + a_4x^4 \dots) - (2a_1x^2 + 2a_2x^3 + 2a_3x^4 \dots) + (a_0x^2 + a_1x^3 + a_2x^4 + \dots)$$
$$= 2^0x^2 + 2^1x^3 + 2^2x^4 \dots$$

$$[G(x) - a_0 - a_1x] - 2x[G(x) - a_0] + x^2[G(x)] = \cancel{x^2}\; x^2(2^0 + 2x + 2^2x^2 \dots)$$
$$= x^2\left(\frac{1}{1-2x}\right) \quad a=1 \quad r=2x$$

$$G(x) - a_0 - a_1x - 2xG(x) + 2xa_0 + x^2G(x) = \frac{x^2}{1-2x}$$

$$G(x) - 2xG(x) + x^2G(x) - a_0 - a_1x + 2xa_0$$
$$G(x)(1-2x+x^2) - 1 - \cancel{2x} + \cancel{2x} = \frac{x^2}{1-2x}$$

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

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

x^2-2x+1
$x^2-x-x+1$
$x(x-1)-1(x-1)$
$(x-1)(x-1)$

$$\frac{x^2+1-2x}{(x-1)(x+1)(1-2x)} = \frac{A}{(x-1)} + \frac{B}{(x-1)} + \frac{C}{(1-2x)}$$
$$= \frac{Ax - A + Bx - B}{1-2x+x^2} + \frac{C}{(1-2x)}$$

$$x^2+1-2x = Ax - A + Bx - B - 2x^2A + 2xA - 2x^2B + 2xB + C - 2xC + x^2C$$
$$x^2+1-2x = -2x^2A - 2x^2B + x^2C - A - B + C + Ax + Bx + 2xA + 2xB - 2xC$$

$x^2 = -2x^2A - 2x^2B + x^2C \qquad 1 = -A - B + C$ — (2) $\qquad -2x = Ax + Bx + 2xA + 2xB - 2xC$

$1 = -2A - 2B + C$ — (1) $\qquad -2 = A + B + 2A + 2B - 2C$

$-2 = 3A + 3B - 2C$

$\cancel{1} = -2A - 2B + \cancel{C}$
$\cancel{1} = \pm A \pm B \pm \cancel{C}$
$0 = -A - B \qquad 1 = B - B + C \qquad \boxed{C=1}$
$-A = B$

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

$$\frac{1}{1-2x} = \frac{A}{1-2x}$$

$\boxed{A = 1}$

$$= 1 \left[\frac{1}{1-2x} \right]$$

$a = 1 \quad r = 2x$

$= 1 (1, 2x, (2x)^2, \ldots \ldots 2^n x^n)$

$a_n = 2^n$

papergrid

Date: / /

Second Order Non homogeneous

$a_n = a_n^{(h)} + a_n^{(p)}$

Case 1 : If $f(x)$ = polynomial and 1 is not the root

$a_n^{(p)} = A_0 + A_1 x^1 + A_2 x^2 + \dots + A_q x^q$

Case 2 : If $f(x)$ = polynomial and 1 is root

~~$a_n^{(p)} = n^m [A_0 + A_1 n +$~~

$a_n^{(p)} = n^m [A_0 + A_1 x + A_2 x^2 + \dots A_q n^q]$

Case 3 : If $f(x) = \alpha b^n$ and b is not root

$a_n^{(p)} = A_0 b^n$

Case 4 : If $f(x) = \alpha b^n$ and b is root

$a_n^{(p)} = A_0 n^m b^n$

$a_0 \neq A_0$

They will give a_0 not A_0

$a_n^{(h)}$ = Homo Formulas .