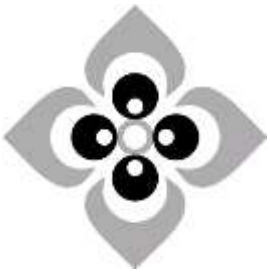

[Frequently Asked Questions]

[Solution of Difference Equations]

Subject:	Business Economics
Course:	B.A., 6th Semester, Undergraduate
Paper No. & Title:	Paper – 631 Advanced Mathematical Techniques
Unit No. & Title:	Unit - 4 Difference Equations
Lecture No. & Title:	2: Solution of Difference Equations

Frequently Asked Questions (FAQ)

1. **How to find homogeneous function of the difference equation?**

   Ans. The homogeneous function can be obtained by setting RHS of difference equation to be zero.

2. **What should be the functional form of particular solution if g_x is polynomial?**

   Ans. Define particular solution as $y_x = A_0 + A_1 x + ... A_n x^n$.

3. **What is the particular solution of difference equation if homogeneous function consists of g_x?**

   Ans. In such a case where the homogeneous solution includes a term similar to the function g_x, the particular solution is $y_x = cxg_x$

4. **What is the homogeneous solution of the difference equation if auxiliary equation has equal roots?**

   Ans. When the auxiliary equation has equal roots $\beta_1 = \beta_2 = \beta$ (say), the homogeneous solution is

   $$y_x = c_1 \beta^x + c_2 x \beta^x$$

5. **What is the homogeneous function of the difference equation if auxiliary equation has complex roots?**

   Ans. When the roots are conjugate complex numbers:

   Let the roots be

   $$\beta_1 = a + ib = r(\cos\theta + i\sin\theta)$$

   $$\beta_2 = a - ib = r\theta(\cos\theta - i\sin\theta)$$

   where $r = \sqrt{a^2 + b^2}$, $\theta = \tan^{-1}\frac{b}{a}$

   The solution is

   $$y_x = d_1 \beta_1^x + d_2 \beta_2^x$$

where d_1 and d_2 are complex conjugates.

Let $d_1 = m + in, d_2 = m - in$

$$d_1\beta_1^x = d_1 r^x(\cos\theta + i\sin\theta)^x = d_1 r^x(\cos\theta x + i\sin\theta x)$$

$$d_2\beta_2^x = d_2 r^x(\cos\theta x - i\sin\theta x)$$

Thus,

$$y_x = r^x[(d_1 + d_2)\cos\theta x + i(d_1 - d_2)\sin\theta x] = r^x[c_1\cos\theta x + c_2\sin\theta x]$$

where $c_1 = d_1 + d_2 = 2m$
$c_2 = i(d_1 - d_2) = -2n$

Thus, c_1 and c_2 are real numbers and we have y_x as a real number.

6. Discuss method to obtain particular solution of second order linear difference equation if g_x is product of exponential and power functions.

Ans. The particular solution is combination of exponential function and polynomial of required degree respectively.