Vision - Potential

Vision Within Every Instructor – Potential Within Every Student

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[1] Percy Lavon Julian

Lawrence Woodard
Grambling State University

Percy Lavon Julian was born April 11, 1899 in Montgomery, Alabama. He attended public school there and graduated in 1916 with honors. He enrolled in DePauw University the following Fall to pursue a degree in "Pre-Med." Little did he know that upon registering he would be classified as a "slow learner" and would be required to enroll in remedial courses for his first two years of study. In order to pay for his education, he worked in one of the fraternity houses washing dishes, scrubbing floors, waiting on tables, and performing any other job which arose. He performed each job assigned just as he did his studies: In an excellent manner. All of his hard work, dedication, commitment, and perservance served him well.He graduated in 1923 as Class Valedictorian and was inducted into Phi Beta Kappa, the most prestigious academic fraternity in the country.

After graduating from DePauw, Percy decided that he was going to study for the PH.D in chemistry rather than pursue a degree in medicine. He was counseled by one of his chemistry professors that this was not a wise decision because "There was no future in Chemistry for a Black Man." However, he decided to follow his own conscience and pursue a Ph.D. in chemistry. It wasn't long before he understood the meaning of his professor's statement as he was unable to obtain any type of scholarship to study chemistry even though he had graduated with the highest honors in his class. Unable to continue his studies without scholarship help, he took a position at Fisk University in Nashville, Tennessee as a chemistry professor. Two years later, Harvard University offered him their Austin Fellowship and the following year (1923), Percy received the Masters Degree in Chemistry. He remained at Harvard to study for his Ph.D., but left after three years unable to find a professor to supervise his research or help him organize a Doctoral Committee. He took a position teaching chemistry at West Virginia State College and then later moved to Howard University as Chair of the Chemistry Department.

Still pursuing his Ph.D., Percy enrolled in the University of Vienna in1929 to study with Dr. Ernest Just. In 1931, Percy Lavon Julian realized his goal as he graduated with his PH.D.in Chemistry. He returned to Howard and later accepted a position at his alma mater, DePauw University. In 1936, he began his industrial career starting with the Institute of Paper Chemistry in Appleton, WI and then a few years later joining the Gliddon Company in Chicago as the Research Director for one of its divisions. During his 12 years with the Gliddon Company, he acquired 66 patents, the most of any researcher associated with the Company.

In 1954, Dr. Julian founded his own research laboratories, "Julian laboratories," one in Chicago, Illinois and one in Empress Ango-Quimica in Guatemala. In 1961, he sold Julian laboratories in Chicago to the pharmaceutical firm of Smith, Kline, and French for $2,338,000. Three years later, he sold his Guatemala lab to the Upjohn Company.

In addition to his earned degrees, Dr. Julian received 15 honorary degrees. He was a member of the Board of Regents of the State of Illinois and a Trustee of DePauw University, Fisk University, Howard University, Roosevelt University, and the Chicago Theological Seminary.

Dr. Julian spent many hours working with youth while teaching in universities and working in industry. One of his major goals was to help develop youth to function at very high levels in our society. He says, with respect to youth,

> "Youth today are seeking self-identification to signify their struggle to find who they are. Properly explored and executed this resolve could be the harbinger of the greatest emancipation vouchsaved to us in three-and-a half long centuries."

[2] Feedback Shift-Registers

Gary Krahn
U.S. Military Academy

The arrival of modern high-speed communications hardware elicited a need for high-speed techniques to generate random-like sequences. Most digital computers and many communication systems handle information in binary form (sequences of ones and zeros). One of the simplest and most efficient devices for generating deterministic random looking sequences of ONEs and ZEROs is the shift-register.

Every periodic binary sequence is obtainable from some suitably constructed linear shift-register. This generality allows great versatility in shift-register applications. The applications for shift-register sequences include secure data transmissions, multiple address coding, error correcting codes, radar range measuring, and random number generation.

Shift-register sequences have a vast amount of internal structure. In this note, we will create shift-registers and observe their output. First we provide a definition which may seem difficult at the first reading. However, the meaning will become clear and understandable after working a couple of examples and then rereading the definition.

Definition of shift-register: (An example will bring this to life!) A span n binary shift- register is a collection $w_i : i = 0, 1, 2, \ldots, n-1$ of n-storage registers each capable of holding one of the values O or 1. The contents of the n-storage registers, the n-tuple $(s_j, s_{j+1}, \ldots, s_{j+n-1})$, is denoted as the state of the register at time j for each ≥ 0. There is an associated feedback rule computed from the contents of the n-storage register called the feedback function defined by
$f(s_j, s_{j+1}, \ldots, s_{j+n-1}) = s_{j+n}$

$$= c_0 s_j \oplus c_1 s_{j+1} \oplus \ldots \oplus c_{n-1} s_{j+n-1}$$

where coefficients $c_o, c_1, \ldots, c_{n-1}$ are ONEs or ZEROs, and the summation is modulo 2 addition (i.e., $1 \oplus 1 = 0,\ 0 \oplus 0 = 0,\ 1 \oplus 0 = 1,$ and $0 \oplus 1 = 1$).

At the pulse of an external clock the contents of the storage register w_{i+1} is shifted into w_i for $1 = 0, 1, 2, \ldots, (n-2)$ and the value of the computed feedback function $f(s_j, s_{j+1}, \ldots, s_{j+n-1})$ is shifted into storage register w_{n-1}.

EXAMPLE: Using the above notation, let $n = 4, c_0 = c_1 = 1, c_2 = c_3 = 0$. Thus $s_{j+4} = s_j \oplus s_{j+1}$. The wiring of this linear feedback shift-register is as follows:

Note: the connections from s_{j+2} and s_{j+3} are open since c_2 and $c_3 = 0$. Successive iterations from the initial configuration look like:

With each tick of the clock, the register completes one step through a sequence of states. If we allow the initial fill of the register to be 0001, then the successive fills or states of the register are

The history of stage w_3, which is underlined, is the sequence 100110101111000, periodically repeated. A sequence generated by a linear shift-register sequence of span n having a period $2^n - 1$ is called a maximum length linear shift-register sequence or m-sequence. These sequences have the wonderful randomness properties of balance, runs, and correlation.

We just created a m-sequence of length $2^4 - 1 = 15$. There are three other 4-span shift-register designs that will create a sequence of length 15. Can you find them? Can you wire it to create a sequence of length 4? What lengths are possible from the 4 stage register? Have fun in your explorations.

(Editor's Note. Professor Krahn does research in coding theory, combinatorics, and graph theory with applications in digital communications. He says that feedback shift-registers, whose theory has been developed within the last 30 years, play important roles in error correcting codes. One of Professor Krahn's many interests is incorporating real and meaningful applications into a student's early stages of studying mathematics.)

[3] College Algebra Activities

N. Nagarajan
Paul Quinn College

I have incorporated the following two activities in my College Algebra course this semester. This semester, the first activity was optional. Next year, I plan to require it of every student.

A. As part of the college Algebra course, students are required to write a paper on any topic of their choice related to college algebra. The requirement includes reading at least one book from the college library or a local library and doing at least 2 problems related to their topic. The book and problems should be approved by the instructor. In addition to the written part of the project, students will give a class presentation on their topic. A student's grade on this project is based on their written paper and on their class presentation. An abstract of the best paper will be submitted for publication in the HBCU Consortium Newsletter, upon approval by a panel of 3 professors.

B. A Classroom Activity (Purpose: help students learn the solution concept of linear equations.)

   One student writes a number on a paper without revealing it to the other members of the class. The following operations are then done to the number:

   a. Multiply the number by 2
   b. Add 2
   c. Multiply by 5
   d. Add 5
   e. Multiply by 10
   f. Add 10.

   The resulting number is then revealed to the class and the students challenged to determine the original number with which they started.

   Some students found the correct answer by a pattern they discovered after 2 or 3 attempts. Later they formed a group to discuss the mathematical reasoning used to obtain the answer.

(Editor's Note: An interesting follow-up to this activity would be to repeat the activity using different numbers and/or operations. Then divide the class into small groups and ask each group to develop a similar activity to challenge another group. Then let the challenges roll.)

[4] A Semester-End Writing Assignment

This is a three part assignment.

A. (This part is done in small groups during class.) Each group develops an outline of the course and then identifies and discusses three or four major themes that were woven through the course.

B. (This part is done outside of class.) Each student writes a paper (2 pages ??) describing each of the themes identified by his or her group. The paper should describe why the themes are important and how they unified the course. Examples illustrating the themes would certainly be appropriate to include as would applications of the themes to activities outside the course or to other courses.

C. Conduct a class discussion begun with the authors of three or four of the best papers presenting their ideas.

[5] Notes

1. The fall 1997 Retreat/Workshop for the HBCU College Algebra Reform Project will be held at Wiley College in Marshall, TX, October 2-4, 1997. The focus of the Retreat will be on the development and use of Interdisciplinary Lively Application Projects (ILAPs) in college algebra.

2. The MAA recently published *Interdisciplinary Lively Application Projects (ILAPs)*, David C. Arney, Editor, in its Classroom Resources Material series. The book contain 8 ILAPs ranging from algebra, trigonometry, and precalculus; through calculus, elementary and intermediate differential equations, and discrete mathematics to advanced calculus and partial differential equations.The partner disciplines included are mechanics, physics, chemistry, engineering, geography,topography, and exercise physiology. The book can be ordered from the MAA by calling 1-800-331-1622.