OBSERVATIONS FOR STUDENTS

Richard W. Hamming

Richard W. Hamming (1915-1998) received his Ph.D. in Mathematics for the University Illinois in 1942. He served as an Assistant Professor at the University of Louisville before joining the Manhattan Project in Los Alamos, New Mexico in 1945. There he worked to maintain the computer systems used in developing the first atomic bomb. His frustrations with those machines, with their propensity for failures due to bit flips, eventually led to his work on error correction and detection.

In 1946, Hamming joined the Bell Telephone Laboratories. He was originally hired to work on elasticity theory but spent increasing amounts of time n computers. Most significant was his work on error-correcting codes for which he was awarded the prestigious Turing Award of the Association of Computing Machinery in 1968.

Hamming retired from Bell Labs at he age of 61 to accept a Chair of Computer Science at the Naval Postgraduate School in Monterey, California. For 21 years he was involved in teaching and writing until his retirement in 1997. He also gave many talks on "learning to learn" and "managing your own research", advocating that "the more you do the more you can do, and the more opportunities are open for you." He always strived to teach his students not only technical skills but also an attitude of respect toward science and mathematics. This document is a testimony of his philosophy.

1. All learning occurs in the student's head.

2. At best, the teacher is only a coach to guide, encourage and criticize your style.

3. The purpose of the examples and exercises cannot be "to get the right answers" because they are already known! Their purpose, like that of running a mile, is to improve you.

4. Apparently, that which you actively learn for yourself you can use later creatively; that which you learn passively you can only use to follow others.

5. The attitude that you are here to be taught rather than to learn is counter productive. So is the attitude that you already know all that is really worth knowing.

6. If you want to succeed (in whatever way you believe is worthwhile) then failing to plan for that success is just plain foolish; you live only once.

7. The purpose of an education is to change you; especially the way you think. Often this is a painful process, but if it does not occur then your time in school was wasted; all you got was a degree.

8. Passively reading a book is not studying – time spent is not a measure of how much you study. Your problem is to get yourself into a mood where you actively want to learn, where you are searching for specific understanding.

9. If you find that the school and the professors are not perfect, then it is a good preparation for life! Profit from their defects.

10. While you need to learn current technologies to do things tomorrow and get ahead, experience strongly suggests that before you are ready to use it much of the material will be only partly relevant, some misleading, and some wrong. Cling to fundamentals, they seem to change more slowly.

11. If lifting 250 pounds is the final test in a weight lifting class, and you cut the weights in half, lift the two 125 pounds separately, and think that you can lift 250 pounds, you are only fooling yourself. Be careful that things that appear to make "getting through" a course easier are not just as foolish. Remember to develop yourself.

12. The most important things you can do while here are:

    a. Learn to learn
    b. Learn to question things
    c. Acquire the permanent habit of learning.

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