Book 18. (1/00 — 12/00)

1. Nörd syndrome + entropy, etc.
4. A comment on the WLLN
6. "Typical Pairs" dealing on the AEC...
3. On r-random permutations
10. Continued from P.7.
11. An Improved Bound for Murray Theorem

3-6-00. On s-random permutations.

Consider the sample space Ω_n consisting of all $n!$ permutations $(\pi(1), \pi(2), \ldots, \pi(n))$. Let $s \geq 1$ be a fixed integer, and suppose $n >> s$. For each ordered pair (i, j) with $1 \leq i < j \leq n$ and $j - i \leq s$, define the random variable

$$X_{(i,j)}(\pi) = \begin{cases} 1 & \text{if } |\pi(i) - \pi(j)| \leq s-1 \\ 0 & \text{if } |\pi(i) - \pi(j)| \geq s. \end{cases}$$

Then define

$$(1) \qquad X_s(\pi) = \sum_{|i-j| \leq s} X_{(i,j)}(\pi),$$

which represents the number of violations of the "s-random" conditions.

For any (i, j),

$$\Pr\{X_{(i,j)}(\pi) = 1\} \approx \frac{2(s-1)}{n}.$$

sorted (giving end effects), there are $2(s-1)$ forbidden

Values for $\pi(1)$, ..., $\pi(s)$ ($\pm 1, \pm 2, ..., \pm (s-1)$). Furthermore, there are $\approx ns$ terms in the sum (1), so

$$E(X_s) \approx 2s(s-1).$$

Assuming then that X_s is Poisson,

$$\Pr[X_s = 0] = e^{-2s(s-1)},$$

which is the probability of finding an s-random permutation. So we have

<u>Conjecture</u>. Let $P_s(n)$ be the number of s-random permutation on n letters. Then

$$\lim_{n \to \infty} \frac{P_s(n)}{n!} = e^{-2s(s-1)}.$$ ▣

3-7-00   A Note on RA Code.

Let A_n be the $n \times n$ "accumulator" matrix:

$$A_6 = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}.$$

Then the "repeat-permute" portion of an RA encoder is simply multiplication by a $(3/6)$ low-density generator matrix G:

$$G = \begin{pmatrix} 1 & 1 & & 1 & & \\ & 1 & & 1 & 1 & 1 \\ & & 1 & & 1 & 1 \end{pmatrix}.$$

Why not replace G with a different LDGM?

$$G = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

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