DOBRUSHIN, R.L.

Lemma on the limit of a complex random function. Usp.mat.nauk 10 no.2:157-159 '55. (MIRA 8:8)
(Probabilities)

DOBRUSHIN, R. L.

Dobrušin, R. L. Two limit theorems for the simplest random walk on a line. Uspehi Mat. Nauk (N.S.) 10 (1955), no. 3(65), 139–146. (Russian) 1-F/W

Let τ_n be the position of a particle after making n steps of a one-dimensional symmetric unit-step random walk. Let f be a function on the integers, with $\sum_{-\infty}^{\infty} f(j)=c$, where the series converges absolutely. Then, if $c\neq 0$, the distribution of $\sum_1^n f(\tau_j)/(cn^{\frac{1}{2}})$ converges to a limit distribution. If $c=0$, and if f vanishes except on a finite set, the distribution of $\sum_1^n f(\tau_j)/(dn^{\frac{1}{4}})$ converges to a limit distribution. Let ξ, η be mutually independent Gaussian random variables with zero expectations and unit variances. Then the above limit distributions are those of $|\xi|$, $|\xi|^{\frac{1}{2}}\eta$ respectively, and d is a positive constant evaluated explicitly in terms of f. Feller [Trans. Amer. Math. Soc. 67 (1949), 98–119; MR 11, 255] proved a special case of the first theorem. Related results have been proved by Kallianpur and Robbins [Duke Math. J. 21 (1954), 285–307; MR 16, 52.] *J. L. Doob* (Urbana, Ill.).

DOOB, Joseph Leo, 1910-,; DOBRUSHIN, R.L.,[translator]; YAGLOM , A.M., [translator], red.

[Stochastic processes] Veroiatnostnye protsessy. Perevod s angliiskogo. Moskva, Izd-vo inostrannoi lit-ry, 1956. 605 p.

(MIRA 11:10)

(Probabilities)

Dobrushin, R. Central limit theorem for non-stationary Markov chains. I. Teor Veroyatnost i Primenen 1 (1956), 72–89. (Russian. English summary) 1-FW

This paper consists of the introduction to a dissertation and includes, in addition to statements of theorems, a brief outline of some of the proofs. The principal theorems are refinements upon those announced previously by the author [Dokl. Akad. Nauk SSSR (N.S.) 102 (1955), 5-8. MR 17, 48] and will be indicated below with the notations of the review just cited. For any transition probability function $P(x, A)$, instead of the measure of ergodicity ρ the author now uses the "ergodic coefficient"

$$\alpha=\alpha(P)=1-\sup|P(x, A)-P(y, A)|,$$

where the supremum is taken for all x, y, and A. Replacing ρ by α in theorems 1) and 2) of the review cited we get Theorems 1 and 2 of the present paper, which are somewhat stronger because $\alpha \geqq \rho$. Moreover, in them the condition involving α_n is best possible. Instead of 3) of the review the author states the following more general result (Theorem 8): under condition (*) of the review if 1/2

Dobrushin, R.

$\alpha_n n^{1/3} \to \infty$, if $F_i^{(n)}(t)$ denotes the cumulative distribution function of $\xi_{in} - \mathscr{E}[\xi_{in}]$, and if, for any $r > 0$,

$$\lim_{n\to\infty} \frac{1}{n\alpha_n^2} \sum_{i=1}^{n} \int_{t^2 \geq r^2 n \alpha_n^2} t^2 dF_i^{(n)}(t) = 0,$$

then ζ_n' is asymptotically normally distributed with mean 0 and variance 1. *H. P. Mulholland* (Birmingham)

1-FW

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DOBRUSHIN, R.L.

Dobrushin, R. L.

Given a system [illegible]

[illegible]

$n\geq 0$, (a) $\lim_{\Delta\to\infty}$ [illegible] and (b) for every $l>0$, $\lim_{l\to\infty}\sum_n$ [illegible] $=0$, where [illegible]

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[illegible] R. [illegible]

is the probability that a particle displacement [illegible] time 0 and t [illegible]

[illegible]

[illegible] the paper reviewed above) proved a special case of this theorem. If (b) is kept but if (a) is replaced by the hypothesis that the initial distribution is invariant under translations, and that M [illegible]

[illegible]

MT

DOBRUSHIN, R. L.

1 F W

Dobrušin, R. L. On the condition of the central limit theorem for inhomogeneous Markov chains. Akad. Nauk SSSR ... 10... (Russian)

If $P(x, B)$ is a transition probability, the author defines

$$\beta = 1 - \sup_{x,B} |P(x, B) - P(y, B)|.$$

Then $\beta \geqq \rho$, where ρ is the coefficient of ergodicity defined in a previous paper [same Dokl. (N.S.) 102 (1955), 5 8; MR 17, 48]. Several theorems on the asymptotic ... of sums of random variables in a Markov process ... in that paper remain true if ρ is replaced ... ing are among further th... minimum β value of the transition functions involved in the sum ζ_n of n random variables ξ_{in} ... Markov process. (I) If

$$\lim_{n\to\infty} (n\beta_n^3)^{-1} \sum_{i=1}^{n} \int_{|t| \geq \ldots} t^2 dP(\xi_{in} - M\xi_{in} < t) = 0$$

DOBRUSIN, R. L.

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for every $\epsilon>0$, and if $0<\text{const}\leq \text{Var}\,\xi_{in}\leq \text{const}<\infty$, then ζ_n is asymptotically normally distributed (with the usual centering and scaling constants). (II) If $|\xi_{in}|\leq \text{const}<\infty$, and if

$$\lim_{n\to\infty} n^{-2/3}\beta_n\left(\sum_{i=1}^{n}\text{Var}\,\xi_{in}\right)=\infty,$$

then ζ_n is asymptotically normally distributed.

J. L. Doob (Geneva).

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MT

DOBRUSHIN, R.L.

Central limit theorem for inhomogeneous Markov chains [with summary in English]. Part 2. Teor.veroiat.i ee prim. 1 no.4:365-425 '56.
(MLRA 10:5)

(Probabilities)

DOBRUSHIN, R.L.

[redacted]

An example of a countable homogeneous Markov process all states of which are instantaneous [with summary in English]. Teor.veroiat.i ee prim. 1 no.4:481-484 '56. (MLRA 10:5)

(Probabilities)

DOBRUSHIN, R.L.

AUTHOR: Dobrushin, R. L. 52-3-7/9

TITLE: Some Classes of Homogeneous Denumerable Markov Processes. (Nekotoryye klassy odnorodnykh schetnykh markovskikh protsessov.)

PERIODICAL: Teoriya Veroyatnostey i Yeye Primeneniya, 1957, Vol.II, Nr.3. pp.377-380. (USSR)

ABSTRACT: The problem of finding all Markov processes having a given system of transition densities is investigated. Up to the present time this problem has been completely solved by Feller (Ref.2) for the regular case when there is exactly one process. Refs.4, 5 and 6, and others, have studied at different levels of strictness and generally, different classes of examples of non-regular processes. In this paper is given a complete description of processes for which the densities satisfy two conditions: the condition of "no beginning", and the condition of a finite number of ends. The condition of "no beginning" is that there need not exist a sequence of non-repeating

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000410710003-5"

Some Classes of Homogeneous Denumerable Markov Processes.

states E_{i_k} such that the densities $a_{i_{k+1},i_k} > 0$ for all k. It would be said that the process which has $n < \infty$ ends $R_1, \ldots, R_n$, if all the states E_i can be split into n non-intersecting sub-sets $R_1, \ldots, R_n$ such that if we denote by D_R the event which is that for all sufficiently large values of time a chosen function of the chain belongs to a set of states R, then (1) $\underline{P}\left\{D_{R_i}\right\} > 0$; $i = 1, \ldots, n$, (2) $\bigcup_{i=1}^{n} D_{R_i}$ is a verifiable true event, (3) for $R \subset R_i$ the probability $\underline{P}\left\{D_R\right\}$ is equal to 0 or to $\underline{P}\left\{D_{R_i}\right\}$. The following theorem is proved: let there be given a compact homogeneous Markov process with no beginning and with a finite number of ends R_i, then all non-regular ends of the process can be split in a unique way into simple ends and groups of particular ends. With each

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Some Classes of Homogeneous Denumerable Markov Processes.

simple end R_j probabilities $q_i^{(j)}$, $r_i^{(j)}$ satisfying

$$\sum_{i=1}^{\infty} q_i^{(j)} + \sum_{i=1}^{\infty} r_i^{(j)} = 1 ; \; j = 1, 2, \ldots, m. \qquad \text{(Eq.1)}$$

can be identified in a single-valued manner. Each group of particular ends S_j can be identified with quantities $u_i^{(j)}$ satisfying conditions

$$\sum_{i=1}^{\infty} u_i^{(j)} \pi_i^k = \infty, \qquad \text{(Eq.3)}$$

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$$\sum_{i=1}^{\infty} u_i^{(j)} \pi_i^k < \infty \qquad \text{(Eq.4)}$$

and

$$\sum_{i=1}^{\infty} u_i^{(j)} m_i^{(j)} < \infty \qquad \text{(Eq.5)}$$

Conversely, let there be given transition densities such that to them correspond processes with no beginning and with a finite number of ends: among all the non-regular ends of the processes let there be given arbitrary ends called "simple ends", and let the remaining non-regular ends be divided into non-intersecting groups. Finally let there be given a choice of numbers $q_i^{(j)}$, $r_i^{(j)}$, and $u_i^{(j)}$ satisfying equations 1, 3, 4 and 5. Then there is a homogeneous Markov process which is unique, having these transition densities, the ends of which are divided into simple ends and groups of

Some Classes of Homogeneous Denumerable Markov Processes. 52-3-7/9

ends as given, and the quantities $q_i^{(j)}$, $r_i^{(j)}$ and $u_i^{(j)}$ so constructed as to correspond with those given. There are 8 references, 3 of which are Slavic.

AVAILABLE: Library of Congress.

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000410710003-5"

DOBRUSHIN, R. L.

SOV/52-2-4-7/7

A Summary of Papers Presented at the Sessions of the Scientific Research Seminar on the Theory of Probabilities. Moscow, Feb-May 1957

Teoriya Veroyatnostey i yeye Primeneniya, 1957, v.2, no.4, pp. 478-88

is supposed that the space R is locally bicompact and has a countable basis. It is further supposed that the stochastic phenomenon is given by its finite dimensional Boolean distributions. Dobrushin, R.L., Certain classes of homogeneous denumerable Markov processes. The contents of this report have been published in Vol.2, Nr.3 of this journal. Rozanov, Yu.A., On linear interpolation of multi-dimensional stationary sequences in a Hilbert space. The contents of this report have been published in the Proceedings of the Academy of Sciences, Vol.116, Nr.6, 1957, pp.923-927. Dobrushin, R.L., On the formulation of Shannon's fundamental theorem. Let ξ which takes values in some space X be a random quantity related to the transmission of information. Let there be given a space $\tilde{X}$ with some class V of distributions of pairs of quantities $(\xi, \tilde{\xi})$ where $\tilde{\xi}$ takes values from $\tilde{X}$ and it is required that the information $\tilde{\xi}$ arising in the transmission of information ξ is such that the distribution of the pair $(\xi, \tilde{\xi})$ belongs to V. Let H be the

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A Summary of Papers Presented at the Sessions of the Scientific Research Seminar on the Theory of Probabilities.

superior limit of information $I(\eta, \tilde{\eta})$, and let

$$C(V) = \inf_{(\zeta,\tilde{\zeta}) \in V} I(\zeta,\tilde{\zeta}).$$

The following theorem is proved: suppose that all the quantities introduced depend on an index T. If for any T (1) there are given non-negative uniformly bounded functions of two variables $\rho_T(x,\tilde{x})$ and for any positive number u the set $V_T(u)$ consists of all the distributions of pairs of $(\xi_T,\tilde{\xi}_T)$ such that

$$M\rho_T(\xi_T, \tilde{\xi}_T) \leqslant u, \qquad \text{(Eq.1)}$$

then (2) there exist regular sequences of quantities $(\eta_T, \tilde{\eta}_T)$ related to the distribution $P_T(y,B)$ where $y \in Y$, $B \subset \tilde{Y}$ such that as $T \to \infty$

$$\frac{I(\eta_T, \tilde{\eta}_T)}{H_T} \to 1,$$

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(3) for some sequence of numbers u_T there exist regular sequences of stochastic quantities $(\xi_T, \tilde{\xi}_T)$ such that their distributions belong to $V_T(u_T)$

$$\lim_{T \to \infty} \frac{I(\xi_T, \tilde{\xi}_T)}{C(V_T(u_T))} = 1$$

(4) if

$$\lim_{T \to \infty} H_T = \infty$$

$$\lim_{T \to \infty} \frac{C(V_T(u_T))}{H_T} < 1,$$

then for any $\varepsilon > 0$ for all sufficiently large T the information η can be transmitted with accuracy $V_T(u_T + \varepsilon)$.

Card ~~6/11~~ 3/3

DOBRUSHIN, R. L. (Moscow)

"The Importance of Mathematical Methods in Linquistics."

Theses - Conference on Machine Translations, 15 - 21 May 1958, Mosocow.

DOBRUSHIN, R. L. (Moscow)

"A Test of the Determination of the Concept of the Grammatical Category."
Theses - Conference on Machine Translations, 15 - 21 May 1958, Moscow.

AUTHOR: Dobrushin, R. L. 52-III-1-6/9

TITLE: The Continuity Condition for Sample Martingale Functions. (Usloviye nepreryvnosti vyborochnykh funktsiy Martingala.)

PERIODICAL: Teoriya veroyatnostey i yeye primeneniya, 1958, Vol.III, Nr.1, pp.97-98. (USSR)

ABSTRACT: It is proved that the condition

$$\sup_{t \in [0,1-\Delta t]} P\left\{|\zeta_t - \zeta_{t+\Delta t}| > \varepsilon\right\} = o(\Delta t) \qquad \text{(Eq.1)}$$

for any $\varepsilon > 0$ as $\Delta t \to 0$ is sufficient for almost all sample functions of a separable stochastic process $\{\zeta_t, t \in [0, 1]\}$ to be continuous. This follows from the more general result: if Eq.1 is true for a separable stochastic process, then almost all sample functions do not have first order discontinuities. There are 3 references of which 2 are Soviet and 1 English.

SUBMITTED: September 25, 1957.

AVAILABLE: Library of Congress.

Card 1/1

1. Martingale functions 2. Stochastic processes

SOV/52-3-2-5/10

AUTHOR: Dobrushin, R. L.

TITLE: A Statistical Problem of Detecting a Signal in the Noise of a Multi-Channel System Reduced to Stable Distribution Laws (Odna statisticheskaya zadacha teorii obnaruzheniya signala na fone shuma v mnogokanal'noy sisteme, privodyashchaya k ustoychivym zakonam raspredeleniya)

PERIODICAL: Teoriya veroyatnostey i yeye primeneniya, 1958, Vol III, Nr 2, pp 173-185 (USSR)

ABSTRACT: A system in radio communication is employed with n channels, each having the tension ξ_i on its output. The variable ξ_i can be considered independently and distributed with density probability (Eq.1) where λ_i is expressed by Eq.(2). The parameter λ_i could be described by two hypotheses A and B . In the first case, with no signal present, all λ_i are the same and equal to $d>0$ (d - mean noise power). This hypothesis considers the output tension of the channels as producing only a noise. In the second case a signal is present. All λ_i , except λ_j are equal to d while $\lambda_j = d + \bar{d}$ $(\bar{d}>0)$. The index j

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SOV/52-3-2-5/10

A Statistical Problem of Detecting a Signal in the Noise of a Multi-Channel System Reduced to Stable Distribution Laws

represents any value of n with probability 1/n . This hypothesis describes the source of tension in all channels as noises except j's which is the tension of working signal with the noise superimposed. A possibility that a working signal can be present at several channels simultaneously is disregarded. The density probability distribution in both cases can be expressed as $p_A(x_1, \ldots, x_n)$ and $p_Б(x_1, \ldots, x_n)$. The ratio $p_Б/p_A$ can be described by the statistic (4). If $\beta = \bar{d}/d$ and ξ_i is distributed with the parameter λ_i then a value η_i is found so that the probability $P\{\eta_i > x\}$ can be calculated for $1 \leqslant x < \infty$. Therefore the statistic (4) in the case of the hypothesis A has a distribution which can be compared with the distribution of the sum (S) of n independent components η_i with probability Eq.(6). Similarly, for the hypothesis B this

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A Statistical Problem of Detecting a Signal in the Noise of a Multi-Channel System Reduced to Stable Distribution Laws

probability can be expressed as Eq.(7). The probability that the hypothesis B is being considered while the hypothesis A is true, can be expressed by (8) and called the "probability of false alarm". For the probability of hypothesis B being considered when actually it is true, the expression (9) is used. It is called the "probability of detection of true signal". If two values F and D exist so that $0 < F \leqslant D < 1$ therefore it is possible to distinguish two hypotheses with probability F or D if the probability of the false alarm is not greater than F, and the probability of the detection of true signal is not smaller than D. The theory of statistics allows in this case the consideration of a criterion based on the statistic φ. Therefore, in order to distinguish the two hypotheses, the parameters n and β are taken with n, F and D as constants. Then it will be possible to find such a limiting value of $\beta_n(F, D)$ that the separation of the hypotheses with probabilities F or D is possible when $\beta \geq \beta_n(F, D)$, and not possible when $\beta_n(F, D) > \beta$. The value of $\beta_n(F, D)$

Card 3/4 expresses a necessary increase of power of the signal above

A Statistical Problem of Detecting a Signal in the Noise of a Multi-Channel System Reduced to Stable Distribution Laws

SOV/52-3-2-5/10

that of the noise so that both can be distinuished with a given probability of error. This probability can be determined as shown below. For any F or D and $n \to \infty$ the formula $\beta_n(F, D)$ can be expressed as Eq.(10), where $p(y)$ is the density of the stable distribution with the parameter $\alpha = 1$ and the characteristic function .(11) with F found from Eq.(12). The formula (10), however, is not practical for the final solution of the problem. Therefore, an asymptotic formula (13) is introduced with D and n constant, and $F \to 0$. The formula (14) could also be employed, but it is not possible to prove it with the same simplicity as it can be done for Eqs.(10) and (13). There are 3 Soviet and 2 English references.

SUBMITTED: November 2, 1957.

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DOBRUSHIN, R.L.

p.3

SOV/52-3-2-10/10

AUTHOR: None Given

TITLE: A Summary of Papers Presented at the Sessions of the Scientific Research Seminar on the Theory of Probability, Moscow, September-March 1957-1958 (Rezyume dokladov, sdelannykh na zasedaniyakh nauchno-issledovatel'skogo seminara po teorii veroyatnostey, Moskva, sentyabr'-mart 1957-58 g.)

PERIODICAL: Teoriya veroyatnostey i yeye primeneniya, 1958, Vol III, Nr 2, pp 212-216 (USSR)

ABSTRACT: A. N. Kolmogorov - Ergodic stationary random processes with a discrete spectrum. If S is a set of numbers and $\xi(t)$ is a stationary ergodic function defined for all random values of t as

$$\xi(t) = \sum_{\lambda \in S} \varphi(\lambda) e^{i\lambda t}$$

then $\rho(\lambda) = |\varphi(\lambda)|$ is not random. Therefore, the unit probability can be expressed as $\rho(\lambda) = +\sqrt{f(\lambda)} > 0$ and $\varphi(\lambda) = \rho(\lambda)e^{i\theta(\lambda)}$ where $\theta(\lambda)$ is defined as mod 2π and represents a random element of the space A_S of all the

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A Summary of Papers Presented at the Sessions of the Scientific Research Seminar on the Theory of Probability, Moscow, September-March 1957-1958

functions $\alpha(\lambda)$. The space A_S represents a compact group with a sub-group B_S . The factorial group

$\Gamma_S = A_S - B_S$ will determine the distribution of

the function $\xi(t)$ becoming isomorphic of the other two.

Ye. B. Dynkin - Infinitesimal operators of "jump" Markov processes. Published in Vol III, Nr 1 of this journal.

V. A. Volkonskiy - A random change of time in strictly Markov processes. If $x_t = x(t, \omega)$ is a homogeneous Markov process on the space $\mathcal{E}$ and $\tau_t(\omega)$ is a function non-decreasing at all ω , and that $\tau_t(\omega)$ at all t is a random value not dependent on future, then the function $y(t, \omega) = x(\tau_t(\omega), \omega)$ is a process obtained from x_t with random change of time τ_t . At some conditions of τ_t the

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the process y_t becomes a homogeneous strictly Markov process. In the case of a homogeneous process with a random change of time and a uniform deformation of space it is possible to obtain any continuous Markov process which will be regular in the interior and absorbed near the boundary.

R. L. Dobrushin - A statistical problem of detecting a signal in the noise of a multi-channel system reduced to stable distribution laws. Published in this issue.

V. M. Zolotarev - Some new properties of stable distribution laws. Published in Vol II, Nr 4 of this journal.

R. A. Minlos - On the extension of the generalized random process to additive measure. Any exact process, such as Gelfand's, based on the cylindrical set of numbers on linear topologic space E' and extended into a space E will retain its additive property defined as the set B on the space E' . (There are 2 references, 1 Soviet and 1 French).

D. M. Chibisov - Limit distribution for the number of runs in a Bernouilli Trials. If k represents a number of independent runs in two trials, the probability of a positive

AUTHOR: Dobrushin, R.L. (Moscow) SOV/52-3-4-3/11

TITLE: Transmission of Information in Channels with Feedback (Peredacha informatsii po kanalu s obratnoy svyaz'yu)

PERIODICAL: Teoriya Veroyatnostey i Yeye Primeneniya, 1958, Vol 3, Nr 4, pp 395 - 412 (USSR)

ABSTRACT: In this article feedback is defined to mean the possibility of sending information in the reverse direction along the channel, the feedback being used to improve the quality of the transmission in the forward direction. For example, if information is easily distorted or particularly important, then the recipient repeats all he hears so that the sender can be sure that the information has been correctly understood. Recently, systems of telegraphic transmission of discrete information have been developed on this principle. Calculations for concrete systems of such a kind have been discussed in Refs 1, 2, 6 and 8. In these papers has also been raised (although not fully solved) the problem of comparing the capacity of systems with and without feedback for the same noise level. In the first part of the present paper a communication channel

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with discrete time is considered in which the symbols presented at different moments of time are distorted independently of each other. Such a channel is called a channel without memory. It is proved that if the information exceeds the capacity of a channel, then it cannot be transmitted through a channel with feedback whatever its capacity. Thus, the use of feedback does not improve the capacity of a channel without memory. It is shown that this situation changes radically when a channel with memory is considered. The problem of the full qualitative evaluation of the possibilities arising remains open. It is solved only for a special class of channels with memory with the assumption that the capacity of channel with feedback is so great that the feedback instantly transmits to the input of the channel complete and distortion-free information about the input signal and that the channel retains the information for a long period and, in particular, for chanels which are related to some random parameter such that for any fixed value of the parameter the channel becomes a channel without memory.

SOV/52-3-4-3/11

Transmission of Information in Channels with Feedback

For such a channel an expression is derived for its asymptotic capacity when not using feedback. There are 9 references, 5 of which are Soviet and 4 English.

SUBMITTED: June 3, 1958

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SOV/52-3-4-8/11

AUTHOR: Dobrushin, R.L. (Moscow)

TITLE: A Simplified Method of Experimentally Evaluating the Entropy of a Stationary Sequence (Uproshchennyy metod eksperimental'noy otsenki entropii statsionarnoy posledovatel'nosti)

PERIODICAL: Teoriya Veroyatnostey i Yeye Primeneniya, 1958, Vol 3, Nr 4, pp 462 - 464 (USSR)

ABSTRACT: Consider random quantity η which is equal to the least positive k such that $\xi_k = \xi_0$ (i.e. η is the time to the next occurrence of the value after the time 0) in terms of probabilities p_i defined in Eq (1): the entropy H of the system is given in Eq (2). If the probabilities p_i are small then the conditional probability of Eq (3) is close to the exponential one given in Eq (4) from which follows a simple approximation for the mathematical expectation of $\log \eta$ ($\log \eta \approx H - C$, where C is Euler's constant). On the basis of the above a method of determining experimentally the entropy is proposed. It is necessary to obtain some (large) number M of observations y_j of the quantity η. Then H is

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A Simplified Method of Experimentally Evaluating the Entropy of a Stationary Sequence

approximated to by Eq (7). The question of applying this method to an arbitrary stationary sequence is discussed briefly. There is 1 English reference.

SUBMITTED: May 5, 1958

Card 2/2

DOBRUSHIN, R. L., Moscow.

"On the Foundations of the Shennonov[Shannon?] Theory of Information."

paper tp be submitted at the Second Prague Conf. on Information Theory, Statistical Decision Functions, and Random Processes, Liblice, near Prague, CSR, 1-6 June 1959.

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000410710003-5"

16(1),16(2) 4

AUTHOR: Dobrushin, R.L. SOV/20-126-3-4/69

TITLE: General Statement of Shannon's Main Theorem in the Information Theory

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 3, pp 474-477 (USSR)

ABSTRACT: According to a fundamental paper of Shannon several authors have tried to give a sufficiently general and mathematically rigorous formulation and a proof of the fundamental theorem of the information theory. The present paper contains a further trial. The proposed variant bases on the ideas of A.N.Kolmogorov. The paper contains a great number of definitions and two very long theorems without proof.
There are 6 references, 3 of which are Soviet, and 3 American.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V.Lomonosov)

PRESENTED: December 26, 1958, by A.N.Kolmogorov, Academician

SUBMITTED: December 25, 1958

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DOBRUSHIN, R. L. Doc Phys-Math Sci -- "Problems of the Shannon theory of optimal coding of information." Len, 1960 (Mos State Univ im M. V. Lomonosov) (KL, 1-61, 178)

S/194/61/000/010/064/082
D271/D301

6,9500

AUTHORS: Dobrushin, R.L., Khurgin, Ya.I. and Tsybakov, B.S.

TITLE: Approximate computation of the transmission capability of radio channels with random parameters

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 10, 1961, 13, abstract 10 I87 (Tr. Vses. soveshchaniya po teorii veroyatnostey i matem. statistike 1958, Erevan, AN ArmSSR, 1960, 164-171)

TEXT: The velocity of information transmission and the transmission capability of a telecommunication channel are considered in conditions of multi-path propagation. It is assumed that channel parameters change very slowly by comparison with the pass band of the channel. In this case channel parameters are regarded as random values remaining constant during time intervals sufficiently long to obtain near optimal coding. 10 references. [Abstracter's note: Complete translation] VB

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DOBRUSHIN, R.L. (Moscow)

Limit approach under the signs of information and enthropy. Teor. veroiat. i ee prim. 5 no.1:29-37 '60. (MIRA 13:10)
(Information theory) (Probabilities)

DOBRUSHIN, R.L. (Moscow)

Properties of sample functions of stationary Gaussian processes.
Teor. veroiat. i ee prim. 5 no.1:132-134 '60. (MIRA 13:10)
(Probabilities)

Dobrushin, R.L.

81854
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C111/C222

16.6100

AUTHOR: Dobrushin, R.L.

TITLE: The Asymptotic Behavior of the Probabilities of Errors When Information is Communicated Through a Channel Without Memory With a Symmetric Matrix of Transition Probabilities

PERIODICAL: Doklady Akademii nauk SSSR, Vol. 133, No. 2, pp. 265-268, 1960

TEXT: Let a stationary discrete channel without memory be defined by the sets of states at the entrance and outlet and by the matrix of the transition probabilities $P = \{p_{ij}, \ i = 1,\dots,M, \ j = 1,\dots,N\}$. The matrix P is called symmetric if every row and column, respectively, can be obtained from every other row and column, respectively, by a permutation of the elements. After numerous definitions theorem 1 gives the asymptotic behavior of the error probability for the transfer of informations through the considered channel with the matrix P symmetric in the above sense. In the special case $M = N = 2$ there follows the result of P. Elias (Ref. 9, 10); an error of (Ref. 9, 10) is corrected. Theorem 2 considers the ratio of the mean error probabilities of an ordinary code and of a group code. Theorem 3 treats the influence of a reduction to the optimal error probability.

~~Card 1/2~~ Moscow State Univ. im M. V. Lomonosov

DOBRUSHIN, R.L. (Moskva)

Mathematical methods in linguistics. Mat.pros. no.6:37-60 '61. (MIRA 15:3)

(Mathematical linguistics)

DOBRUSHIN, R.L.

Inductive game. Mat.pros. no.6:310,328 '61. (MIRA 15:3)
(United States—Games)

DOBRUSHIN, R.L.

Mathematical problems concerning Shannon's theory on optimum coding of information. Probl.pered.inform. no.10:63-107 '61.

(MIRA 14:8)

(Information theory)

DOBRUSIN, R.L. [Dobrushin, R.L.]; MEDGYESSY, Pal [translator]

General formulation of Shannon's basic theorem in the field of information theory. Mat kozl MTA 11 no.4:428-456 '61.

1. Magyar Tudomanyos Akademia Matematikai Kutato Intezete (for Medgyessy).

(7)

BA[illegible]V, A. E., Moscow Institute of Radio Engineering and Electronics - "On designs for automatic recognition of patterns in noise" (Section III)

BRAYNES, S. N., and SVECHINSKIY, V. B., Biocybernetical Institute, University of Moscow - "Matrix structure in stimulating of learning" (Section VII)

DOBRUSHIN, R. L., and TSYBAKOV, B. S., Moscow Institute of Radio Engineering and Electronics - "Information transmission with additional noise" (Section XI)

FLEYSHMAN, B. S., Moscow Institute of Radio Engineering and Electronics - "Basic theorems of the constructive information theory" (Section VIII)

NAPALKOV, A. V., Chair of Higher Nervous Activity, Moscow State University - "Mechanisms of the selection of useful and trustful information" (Section IX)

REPORT to be submitted for the International Symposium on Information Theory, Brussels, Belgium, 3-7 Sep 1962

YEFIMOCHKINA, Yevgeniya Petrovna; DOBRUSHIN, R.L., doktor fiz.-mat. nauk, retsenzent; MOISEYENKO, Ye.V., red.

[Elements of the theory of random processes] Elementy teorii sluchainykh protsessov. Moskva, Mosk. aviatsionnyi in-t im. Sergo Ordzhonikidze, 1962. 37 p. (MIRA 17:4)

MIKHALEVSKIY, B.N.; NEMCHINOV, V.S., akad., otv. red.; BOYARSKIY, A.Ya., prof., doktor ekon. nauk, red.; DOBRUSHIN, R.L., kand. fiz.-mat. nauk, red.; MSTISLAVSKIY, P.S., kand. ekon. nauk, red.; KHOMYAKOV, A.I., red.izd-va; TIKHOMIROVA, S.G., tekhn. red.

[Transactions of the Conference on the Application of Mathematical Methods in Economic Research and Planning] Trudy Nauchnogo soveshchaniya o primenenii matematicheskikh metodov v ekonomicheskikh issledovaniiakh i planirovanii, Moscow, 1960. Moskva, Izd-vo Akad. nauk SSSR. Vol.2. [Mathematical analysis of expanded production] Matematicheskii analiz rasshirennogo vosproizvodstva. 1962. 266 p. Vol.3.[Interbranch balance of the means of production and its distribution in the national economy] Mezhotraslevoi balans proizvodstva i raspredeleniia produktsii v narodnom khoziaistve. 1962. 342 p. Vol.7.[Mathematical statistics] Matematicheskaia statistika. 1962. 232 p.
(MIRA 15:5)

(Continued on next card)

MIKHALEVSKIY, B.N.--- (continued) Card 2.

1. Nauchnoye soveshchaniye o primenenii matematicheskikh metodov v ekonomicheskikh issledovaniyakh i planirovanii, Moscow, 1960. 2. Laboratoriya po primeneniyu matematicheskikh metodov v ekonomicheskikh issledovaniyakh i planirovanii Akademii nauk SSSR (for Mikhalevskiy). 3. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova (for Boyarskiy). 4.Institut ekonomiki Akademii nauk SSSR (for Mstislavskiy).
(Economics, Mathematical--Congresses)

38134
S/052/62/007/002/003/005
C111/C222

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AUTHOR: Dobrushin, R.L.

TITLE: Optimal binary codes for small rates of transmission of information

PERIODICAL: Teoriya veroyatnostey i yeye primeneniya, v.7, no. 2, 1962, 208-213

TEXT: Let B^n be the space of all sequences from 0 and 1 with length n .
Let $\rho(x,y) = \sum_{k=1}^{n} \varphi(x^k, y^k)$, where $x = (x^1,\ldots, x^n)$; $y = (y^1,\ldots, y^n)$; $x,y \in B^n$; $\varphi(a,b) = |a-b|$ be the metric of B^n. Each set of elements $\overline{x}_1,\ldots, \overline{x}_N$ from B^n is denoted as a code K with volume N and length n. Let $d(K) = \min_{i \neq j} \rho(\overline{x}_i, \overline{x}_j)$ and $d(N,n) = \max d(K)$, where max is extended over all codes with volume N and length n. The author proves

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Theorem 1. For every fixed N and $n \to \infty$ it holds

$$d(N,n) = \alpha_N n + O(1) \qquad (1)$$

where $O(1)$ is uniformly bounded in n and

$$\alpha_N = \begin{cases} \frac{1}{2}\left(1 + \frac{1}{N-1}\right) & \text{for even } N \\ \frac{1}{2}\left(1 + \frac{1}{N}\right) & \text{for odd } N . \end{cases}$$

Furthermore, for all N

$$d(N,n) \leq \alpha_N n , \qquad (2)$$

where the equality sign holds for $n = mC_N$, where m is an integer and

$$C_N = \begin{cases} N!/2\left(\frac{N}{2}\right)!\left(\frac{N}{2}\right)!, & \text{for even } N \\ N!/\left(\frac{N+1}{2}\right)!\left(\frac{N-1}{2}\right)! & \text{for odd } N. \end{cases} \quad (3)$$

Assume that there is given, by the matrix $\begin{pmatrix} p_{o1} & p_{o2} \ldots\ldots & p_{og} \\ p_{11} & p_{12} \ldots\ldots & p_{1g} \end{pmatrix}$ of transition probabilities a timely homogeneous channel without memory with binary input and the states $E_1, \ldots, E_g$ at the output. The channel is called symmetric, if for a certain c $(2c \leqslant d)$ and a certain numbering

$$p_{o\alpha} = p_{1,c+\alpha}, \; p_{1\alpha} = p_{o,c+\alpha}, \; 0 \leqslant \alpha \leqslant c, \; p_{o\alpha} = p_{1\alpha}, \; 2c < \alpha \leqslant g .$$

Let C^n be the space of all sequences $(E_{i_1}, \ldots, E_{i_n})$.

Optimal binary codes for small rates ... S/052/62/007/002/003/005
C111/C222

Let

$$q(K,f) = \frac{1}{N} \sum_{i=1}^{N} \sum_{f(c) \neq i} p(c/\overline{x}_i) \quad , \qquad (10)$$

where the transition probability $p(c/\overline{x})$ for $c = (E_{i_1},\dots,E_{i_n})$ and $(x^1,\dots,x^n)$ is defined by $p(c/\overline{x}) = p_{x^1 i_1} p_{x^2 i_2} \cdots p_{x^n i_n}$, be denoted as the medium probability of the error for the code $K = \{\overline{x}_i\}$ and the decoding $f(c)$, $c \in C^n$. Let further

$$q(K) = \inf_f q(K,f) \qquad (11)$$

and $q(N,n) = \inf_K q(K)$, where inf is extended over all K with volume N and length n . K_N^n is assumed to be a code with the property

$$d(K_N^n) = \alpha_N n \ . \qquad (6)$$

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The sign $a(n) \asymp b(n)$ is to denote that

$$0 < \varliminf_{n\to\infty} \frac{a(n)}{b(n)} \leqslant \varlimsup_{n\to\infty} \frac{a(n)}{b(n)} < \infty.$$

The author proves
Theorem 2 : For a symmetric channel with binary input it holds for every fixed N and $n \to \infty$

$$q(N, n) \asymp \frac{1}{\sqrt{\alpha_N n}} \left[\sum_{i=1}^{d} p_{0i} \left(\frac{p_{1i}}{p_{0i}} \right)^{\gamma} \right]^{\alpha_N n}. \quad (12)$$

where γ is the unique root of

$$\sum_{i=1}^{s} p_{oi} \log \frac{p_{1i}}{p_{oi}} \left(\frac{p_{1i}}{p_{oi}}\right)^{\gamma} = 0 \quad , \qquad (13)$$

where

$$q(N,n) \asymp q(K_N^n) \ . \qquad (14)$$

SUBMITTED: April 21, 1960

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S/052/62/007/003/002/004
C111/C333

AUTHOR: Dobrushin, R. L.

TITLE: Asymptotic evaluations of the error probability for the transmission of messages over a discrete memoryless communication channel with a symmetric matrix of transaction probabilities

PERIODICAL: Teoriya veroyatnostey i yeye primeneniye, vol. 7, no. 3, 1962, 283-311

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TEXT: A memoryless channel with a matrix of transaction probabilities $P = \{ p_{ij} \}$ is considered such that any row of $\{ p_{ij} \}$ is a permutation of any other row, and any column is a permutation of any other column. $K_n = [e^{nH}]$ messages are transmitted, where $[a]$ denotes the largest whole number contained in a, and where H is smaller than the transmission capacity C of the channel. Here the k-th message is coded by a word e_k, and as the word $\bar{e}$ leaves the channel it is decided with the probability $r_k(\bar{e})$ that the k-th message was transmitted; e_k

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4

and $\bar{e}$ have the length n;

$\sum_{k=1}^{K} r_k(\bar{e}) = 1$. The probability of the error is denoted by

$\frac{1}{K} \sum_{k=1}^{K} \sum_{\bar{e}} p(\bar{e} / e_k) \left[1 - r_k(\bar{e}) \right]$; the optimal probability of the error $P_n(K)$ is the infimum of the preceding expression. It is shown that for $H < C$ it always holds that $\hat{P}_n(K) \leq P_n(K) \leq \tilde{P}_n(K)$, where $\tilde{P}$ is an averaged probability. Asymptotic expressions are given for $\hat{P}_n(K)$ and $\tilde{P}_n(K)$ with the help of the functions

$$R(h) = \frac{1}{M} \sum_{i=1}^{M} (p_{i1})^h, \; m(h) = \frac{d \log R(h)}{dh}, \; \sigma^2(h) = \frac{dm(h)}{dh} \qquad (1.24)$$

and under the assumption $\sigma^2(h) > 0$. For example, it holds for every $H < C$:

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$$\hat{P}_n(K_n) \asymp n^{-\frac{1}{2h_o}} \left[NR(h_o)\right]^n \exp\left\{n(1-h_o)\, m(h_o)\right\} \qquad (1.28)$$

where h_o is defined by

$$\log R(h_o) - h_o m(h_o) = -H \qquad (1.25)$$

4

The asymptotic of the error is determined for $H > H_{cr}$ up to a constant; the logarithmic asymptotic is obtained for $H = H_{cr}$. Asymptotically nonidentical upper and lower estimates are given for $H < H_{cr}$. (Here H_{cr} is that value of H, for which $h_o = 1/2$). Finally, the case $\sigma(h) \equiv 0$ is considered where $\hat{P}_n(K_n) = 0$. An error in Ref. 9 (P. Elias, Coding for two noisy channels, Proc. Lond. Symp. on Inf. Theory, Butteworth Scient. Publ., Lnd., 1955) is pointed out: the assumption that $k_1 = np_1$ is false, it only holds that $k_1 = up_1 + O(\log n)$.

The most important English language references are: A. Feinstein,

Asymptotic evaluations of the error ... S/052/62/007/003/002/004
C111/C333

Error bounds in noisy channels without memory, IRE Trans. on Inform. theory, Sept. (1955), 13-14; C. E. Shannon, A mathematical theory of communication, Bell. Syst. Techn. Journ., 27 (1948), 379-423, 623-656; C. E. Shannon, Certain results in coding theory for noisy channels. Inf. and Contr. I, 1 (1957), 6-25; J. Wolfowitz, Strong converge of the coding theorem for semicontinuous channels, Illin. Math. J., 3,4 (1955), 477-489).

4

SUBMITTED: April 11, 1960

Card 4/4

VOROB'YEV, N.N., red.; GNEDENKO, B.V., red.; DOBRUSHIN, R.L., red.; DYNKIN, Ye.B., red.; KOLMOGOROV, A.N., red.; KUBILYUS, I.P. [Kubilius, I.P.], red.; LINNIK, Yu.V., red.; PROKHOROV, Yu.V., red.; SMIRNOV, N.V., red.; STATULYAVICHYUS, V.A.[Statuliavicius, V.A.], red.; YAGLOM, A.M., red.; MELINENE, D., red.; PAKERITE,O., tekhn. red.

[Transactions of the Sixth Conference on Probability Theory and Mathematical Statistics, and of the Colloquy on Distributions in Infinite-Dimensional Spaces]Trudy 6 Vsesoiuznogo soveshchaniia po teorii veroiatnostei i matematicheskoi statistike i kollokviuma po raspredeleniiam v beskonechnomernykh prostranstvakh. Vilnius, Palanga, 1960. Vil'nius, Gos.izd-vo polit. i nauchn. lit-ry Litovskoi SSR, 1962. 493 p. (MIRA 15:12)

1. Vsesoyuznoye soveshchaniye po teorii veroyatnostey i matematicheskoy statistike i kollokviuma po raspredeleniyam v beskonechnomernykh prostranstvakh. 6th, Vilnius, Palanga, 1960.
(Probabilities--Congresses) (Mathematical statistics--Congresses)
(Distribution (Probability theory))--Congresses)

S/582/62/000/008/005/013
D405/D301

AUTHOR: Dobrushin, R. L. (Moscow)

TITLE: Asymptotic estimate of error probability in message transmission over a memoryless channel with the use of feedback

SOURCE: Problemy kibernetiki. no. 8. Moscow, 1962, 161-168

TEXT: A theorem is proved which shows that the use of feedback cannot reduce the error probability if $H \geqslant H_{cr}$. The optimal error probability in transmission with feedback is defined as

$$w_n(K) = \inf p(R) \qquad (6)$$

where p is the transition-matrix element, R the method of transmission and K an integer. The case $H < C$ (which is of more importance in practice) is considered, on the assumption that the chan-

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nel has a symmetrical matrix P such that each of its rows is obtained by permutation from another row and each of its columns is obtained by permutation from another column (H is the entropy and C the channel capacity). The question of comparing the error probability w_n (without feedback) with the error probability P_n (in the presence of feedback) for $H < H_{cr}$ remains open. For an arbitrary H ($C > H > 0$) the following (weaker) theorem holds:

$$\overline{\lim_{n \to \infty}} \frac{w_n([e^{nH}])}{n^{-1/2h_0} e^{n[\log R(h_0) + (1 - h_0)m(h_0) + \log N]}} < \infty \qquad (19)$$

After setting

$$\hat{P}_n(K) = 1 - \sum_{u=1}^{s} y_u^{(n)} \qquad (22)$$

one arrives at the inequality: for any n and K

$$\hat{P}_n(K) \leqslant w_n(K) \qquad (24)$$

The proof of both above-mentioned theorems is based on this inequality, whose proof constitutes the main object of the present paper. Thereby the author proceeds from R with non-randomized coding and decoding respectively.

SUBMITTED: May 12, 1961

KONDRATOV, Aleksandr Mikhaylovich; DOBRUSHIN, R.L., doktor fiz.-matem. nauk, nauehnyy red.; ZUBKOV, M.A., otv. red.; PUSHKOVA, S.K., tekhn. red.

[Numbers and thought] Chislo i mysl'. Moskva, Detgiz, 1963. 141 p. (MIRA 16:6)

(Cybernetics)

DOBRUSHIN, R.L.

Theory of coding. Study of probability error in optimum transmission techniques. Izv. AN SSSR. Tekh. kib. no.5: 81-84 S-O '63. (MIRA 16:12)

DOBRUSHIN, R.L.; TSYBAKOV, B.S.

Transmission of information with additional noise. Probl.. pered. inform. no.14:21-42 '63. (MIRA 16:12)

DOBRUSHIN, R.L.

DOBRUSZYN, R.L. [Dobrushin, R.L.]; CHURGIN, J.I. [Khurgin, Ya I.]
(Moskwa)

Problems of the information theory. Rocz wiad matem 6
no.2:205-216 '63.

DOBRUSZYN, R.L. [Dobrushin, R.L.] (Moskwa)

Mathematical methods in lingpistics. Rocz wiad matem 6 no.2:217-242 '63.

DOBRUSHIN, R.L. (Moscow)

Asymptotic optimality of group and systematic codes for some channels.
Teor. veroiat. i ee prim. 8 no.1:52-66 '63. (MIRA 16:3)
(Errors, Theory of)

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000410710003-5"

DOBRUSHIN, R.L.

Unified methods for transmitting information through discrete channels without memory and communications with independent components. Dokl. AN SSSR 148 no.6:1245-1248 F '63. (MIRA 16:3)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. Predstavleno akademikom A.N.Kolmogorovym.
(Information theory)

S/020/63/149/001/001/023
B112/B186

AUTHOR: Dobrushin, R. L.

TITLE: Unified methods for the transmission of information: the general case

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 149, no. 1, 1963, 16 - 19

TEXT: In this paper the author investigates the same problems as in DAN, 148, No. 6(1963), but he does so from a more general point of view. Systems of information $S = \{S^n\}$ are considered, the components of which are not independent. The numbers $\alpha_m(S) = \sup_{Q \in S^n, n \geq m} \alpha_m(Q)$, where $\alpha_m(Q) = \sup|Q(A \cap B) - Q(A)Q(B)|$, have to fulfill the condition $\alpha_m(S) = O(e^{-\varkappa m})$ for a certain $\varkappa$. The principal result is as follows: if the system S satisfies a certain condition of agreement then $H(\varepsilon,S) = \lim h(\varepsilon,[S^n])/h$. This result is applied to channels with and without memory.

Card 1/2

Unified methods for the ... S/020/63/149/001/001/023
B112/B186

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

PRESENTED: August 31, 1962, by A. N. Kolmogorov, Academician

SUBMITTED: August 4, 1962

Card 2/2

DOBRUSHIN, R.L. (Moscow)

Conditions of the asymptotic existence of the configuration integral of the Gibbs distribution. Teor. veroiat. i ee prim. 9 no.4:626-643 '64. (MIRA 17:12)

L 21010-65 EWT(d)/T/EWP(1)/ Pg-4/Pn-4/P1-4/Pb-4/ IJP(c)/ASDC(a)/ASD(a)-5/AFMD(p)
AFETR/RAEM(d)/RAEM(c)/RAEM(i)/ESD(c)/ESD(dp)/ESD(t)/AMD

S/2582/64/000/012/0113/0123

ACCESSION NR: AT5000719

AUTHOR Dobrushin, R. L. (Moscow)

B+1

TITLE. In connection with the sequential decoding method of Wozencraft and Reiffen

SOURCE: Problemy* kibernetiki, no. 12, 1964, 113-123

TOPIC TAGS: information theory, error correcting code, error location coding, binary code

ABSTRACT: Reference is made to the hypotheses offered by Wozencraft and Reiffen concerning sequential decoding of transmitted symbols (J. M. Wozencraft. Sequential decoding for reliable communication, IRE Nat. Conv. Rec. 5, 2, 1957, 11-25, and J. M. Wozencraft and B. Reiffen, Sequential Decoding, Technology Press and J. Wiley, N.Y.-London, 1961). The author contradicts the Wozencraft - Reiffen hypothesis stating that the mean number of operations (machine cycles) needed to decode one transmitted symbol grows as $(\log \frac{1}{p})^{\gamma}$, where p is a small probability of error and γ is a constant. A modification to the algorithm was originally suggested by Koshelev and Pinsker and further developed by the author. A summary is made of coding nomenclature used by Wozencraft and Reiffen. A^n is the set of all sequences of an

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n-bit binary code which is represented in a tree-like structure (see Fig. 1 on the Enclosure) wherein branching is based upon the sequence of most significant (left-most) bits. A code is called random standard code if the probabilities of error in any bit position are independent and equally distributed. The transmitted word includes both data bits and check bits as defined by Hamming. The author proves that the mathematical expectation of error for the random standard tree code is given by $M_n > e^{n\mu}$, where $\mu > 0$ and n is the word length. Orig. art. has: 31 equations and 1 figure.

ASSOCIATION: none

SUBMITTED: 15Jun63 ENCL: 01

SUB CODE: DP NR REF SOV: 001 OTHER: 003

Card 2/3

ENCLOSURE: 01

L 21010-65

ACCESSION NR: AT5000719

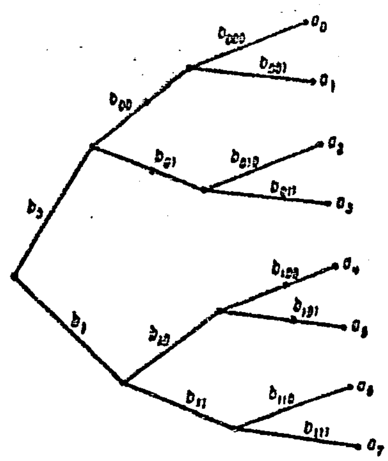

Fig. 1.

Card 3/3

L 63286-65 EWT(d)/T/EWP(1) Pg-4 IJP(c)

ACCESSION NR: AP5015093 UR/0052/65/010/002/0209/0230

AUTHOR: Dobrushin, R. L. (Moscow)

19
B

TITLE: Existence of phase transition in two- and three-dimensional Ising models

SOURCE: Teoriya veroyatnostey i yeye primeneniya, v. 10, no. 2, 1965, 209-230

TOPIC TAGS: mathematical model, existence theorem, lattice parameter, phase transition

16

ABSTRACT: A new method was developed to prove quantitatively the existence of phase transitions in ν-dimensional integral lattices with Ising models of potential

$$U(b) = -\frac{1}{2}\sum_{i\neq j} U(X_i, X_j). \quad (1)$$

The method consists of proving the following two theorems: theorem 1-assume

$$Q(T) = \frac{S_\nu\left(1-\exp\left\{-\frac{1}{2T}\right\}\right)}{3\left(1+\exp\left\{-\frac{\nu}{T}\right\}\right)} \sum_{k=2\nu}^{\infty}\left(3\exp\left\{-\frac{1}{2T}\right\}\right)^k k^{\frac{\nu}{\nu-1}}, \quad (2)$$

where S_ν -the volume of a ν-dimensional sphere with a unit surface. Then if

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L 63286-65

ACCESSION NR: AP5015093

$\nu > 1$ and

$$Q(T) < \frac{1}{v} < 1 - Q(T), \quad (3)$$

at the point (v,T) there exists a phase transition. As a criterion for the presence of a phase transition, a second theorem is proved which states: in order that the point (v,T) be a phase transition point, it is necessary and sufficient that at some $\varepsilon > 0$ for some sequence there is enclosed in a fundamental cube a sub-cube S_l, with side k_l, such that

$$0 < \underline{\lim}_{l\to\infty} \frac{k_l}{l} \leqslant \overline{\lim}_{l\to\infty} \frac{k_l}{l} < 1 \quad (4)$$

and for any sequence N_l, for which

$$\frac{V_l}{N_l} \to v \quad (l \to \infty), \quad 1 < v < \infty \quad (5)$$

is true, then

$$\overline{\lim}_{l\to\infty} \frac{1}{N_l} \log \mathcal{P}_{N_l, l} \left\{ \left| \frac{\mu_{S_l}}{k_l^{\nu}} - \frac{1}{v} \right| > \varepsilon \right\} = 0. \quad (6)$$

The proofs of these theorems are followed by a detailed geometric characteristics study for V_l lattice arrangements. To this end, with each point $X = (x_1, \ldots, x_\nu) \in V_l$ a cube is connected (see Fig. 1 on the Enclosure) with side 1 and with

Card 2/5

center at point X. Also, for each arrangement $b \in \mathcal{B}(N, V_l)$ there exists the region G(b), obtained by summing the cubes, corresponding to the points of that arrangement. It is then shown that given two lemmas plus the second theorem stated above there follows the first theorem. These lemmas are stated as: lemma I-if (3) is fulfilled, there exist positive numbers $M < \infty$, $D < \infty$ and $\delta > 0$ (depending only on v and T) such that the arrangement $b \in \mathcal{B}(N, V_l)$ is (M, D, δ)-fold, and approaches 1 for $l \to \infty$. Lemma 2-for fixed M, D, δ and

$$\alpha \leqslant \alpha_0 (M, D, \delta), \quad (7)$$

for any sufficiently large l and any (M, D, δ)-fold arrangement $b \in \mathcal{B}(N, V_l)$ one can find a sub-cube S(b) with sides $[\alpha l]$ and initial points $(r_1 [\alpha l] + 1, \ldots, r_v [\alpha l] + 1)$ where the r's are whole numbers, such that at

$$\varepsilon = \frac{\delta}{10} \min\left(\frac{1}{v}, 1 - \frac{1}{v}\right) \quad (8)$$

with magnitude

$$\left| \frac{\mu_{S(b)}(b)}{[\alpha l]^v} - \frac{1}{v} \right| > \varepsilon. \quad (9)$$

These lemmas are proven by means of six additional lemmas, the last of which

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states that for the set of arrangements $F_N(M,D,\epsilon)$ one has

$$\mathcal{P}_{N,l}(b \notin F_N(M,D,\varepsilon)) = \frac{1}{Z(N,l)} \sum_{b \notin F(M,D,\varepsilon)} \exp\left\{-\frac{\Gamma(b)}{2T}\right\} = \frac{\mathcal{P}_l(b \notin F(M,D,\varepsilon))\, Z(l)}{Z(N,l)} \quad (10)$$

and for $\gamma > 0$ and for any sufficiently large l the following inequality holds

$$V_l Q(T)(1+\gamma) \leqslant N_l \leqslant V_l - V_l Q(T)(1+\gamma). \quad (11)$$

Orig. art. has: 116 formulae and 2 figures.

ASSOCIATION: none

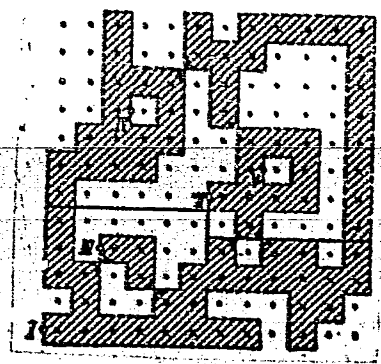
SUBMITTED: 30Sep64 ENCL: 01 SUB CODE: SS, MA

NO REF SOV: 001 OTHER: 007

Card 4/5

L 63286-65
ACCESSION NR: AP5015093

ENCLOSURE: 01



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DOBRUSHIN, R.L.

Existence of a phase transition in two-dimensional and three-dimensional Ising models. Dokl. AN SSSR 160 no.5:1046-1048 F '65. (MIRA 18:2)

1. Submitted September 18, 1964.

L 36968-65 EWT(1)

ACCESSION NR: AP5000565 S/0052/64/009/004/0626/0643

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B

AUTHOR: Dobrushin, R. L. (Moscow)

TITLE: An investigation of conditions for asymptotic existence of the configuration integral for the Gibbs distribution

SOURCE: Teoriya veroyatnostey i yeye primeneniya, v. 9, no. 4, 1964, 626-643

TOPIC TAGS: Gibbs distribution, configuration integral, statistical mechanics, potential energy, mechanics

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ABSTRACT: In classical statistical mechanics, the state of a system containing N identical particles is usually described by a set of their coordinates and momenta. Since investigation of such a system can easily be reduced to the case in which only particle coordinates are discussed, assume that the state of a system is given by the vector $x = (x_1, \ldots, x_N)$, $x_i \in V$, and for simplicity, that V is an n-dimensional cube. It is usually assumed that such a system of particles is described by the Gibbs distribution, which is given by the probability density

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$$p(x) = \frac{\exp(-\beta U(x))}{Q(V, N)}, \quad (1.1)$$

where β is a fixed parameter inversely proportional to temperature and $[Q(V,N)]^{-1}$ is a normalizing factor given by the νN-th integral

$$Q(V, N) = \int_V \ldots \int_V \exp(-\beta U(x))\, dx_1 \ldots dx_N, \quad (1.2)$$

which is called the configuration integral. The function U gives the potential energy of the system in the state x, and it is usually assumed that the potential energy depends only on the distances between pairs of particles, as a result of which the author assumes that

$$U(x) = \sum_{1 \leqslant i < j \leqslant N} \Phi(|x_i - x_j|), \quad (1.3)$$

where $\Phi(y)$, $0 \leqslant y < \infty$, is a real measurable function that may take the value $+\infty$. It is usually assumed that the finite limit

$$\lim_{N \to \infty} \frac{1}{N} \log \frac{1}{N!} Q(V_N, N) = f(v) \quad (1.6)$$

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exists when the volume $|V_n|$ of the region V_n is such that

$$\frac{|V_n|}{N} \to 0 \quad (N \to \infty). \qquad (1.7)$$

An exception is provided by the case in which $\Phi(y)$ takes the value $+\infty$, when f(v) may also take the value $+\infty$. The author finds conditions that must be satisfied by Φ (y) for the finite limit f(v) to exist; in some sense, these conditions are also necessary. Orig. art. has: 98 equations.

ASSOCIATION: None

SUBMITTED: 20May64 ENCL: 00 SUB CODE: ME, MA

NR REF SOV: 003 OTHER: 006

Card 3/3

DOBRUSHIN, V.A.; KANDYKIN, A.Ye., tekhnicheskiy redaktor.

[Books on locomotives; a catalog] Knigi po lokomotivnomu khoziaistvu; katalog literatury. Moskva, 1956. 16 p. [Microfilm] (MIRA 10:6)

1. Vsesoyuznyye izdatel'sko-poligraficheskoye ob"yedineniye "Transzheldorizdat."

(Bibliography--Locomotives)

DOBRUSHIN, V.A., otv. za vypusk,; STIKHNO, T.V., tekhn. red.

[Textbooks and manuals for students taking correspondence classes from universities and technical schools] Uchebniki i uchebnye posobiia dlia zaochnikov vuzov i tekhnikumov. [Moskva] 1958. 13 p. (MIRA 11;12)

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DOBRUSHIN, V.A., otvet. za vypusk; VERINA, G.P., tekhn.red.

[Classified plan of literature to be published during 1959 by the State Publishing House for Railroad Transportation Literature; catalog of literature in print] Tematicheskii plan vypuska izdanii transzheldorizdata na 1959 g.; katalog literatury, imeiushcheisia v nalichii. Moskva, Gos.transp. zhel-dor.izd-vo, 1958. 128 p. (MIRA 12:11)
(Bibliography--Railroad engineering)

DOBRUSHIN, V.A.; MILOVANOV, V.S.; KARPOVA, N.L., red.; KHITROV, P.A., tekhn. red.

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(Bibliography--Railroads)

DOBRUSHIN, Ye.S., inzh.

Machine tool for cold bending of pipes without fillers and some technological parameters of the bending. Mash.Bel. no.5: 16-18 '58. (MIRA 12:11)

(Pipe bending)

SOV/39-45-3-3/7

AUTHOR: Dobrushina, I.S. (Moscow)

TITLE: Typical Irregularities for a Mapping of a k-dimensional Differentiable Manifold into a (2k-2)-dimensional Vector Space (Tipichnyye neregulyarnosti pri otobrazhenii k-mernogo differentsiruyemogo mnogoobraziya v (2k - 2)-mernoye vektornoye prostranstvo)

PERIODICAL: Matematicheskiy sbornik, 1958, Vol 45, Nr 3, pp 333-368 (USSR)

ABSTRACT: The author uses the notions manifold, boundary of a manifold, irregular point of a mapping, neighborhood of class m of a mapping to another one, as they are used in the investigation of Pontryagin [Ref 1] concerning smooth manifolds and their application in homotopy theory. She considers the mapping of a compact manifold M^k into the (2k-2)-dimensional vector space A^{2k-2}. Let f be a smooth mapping of class $m \geqslant 4$ (for $k > 2$ it is sufficient $m \geqslant 3$) of M^k into A^{2k-2}. Let a be an irregular point of f and let $x^1, \ldots x^k$ be a local coordinate system in the neighborhood of a, so that $\frac{\partial f(a)}{\partial x^1} = 0$. In the case

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Typical Irregularities for a Mapping of a k-dimensional Differentiable Manifold into a (2k-2)-dimensional Vector Space SOV/39-45-3-3/7

$k > 2$ the irregular point a is called non-degenerated, if it holds (B) : For a certain $i = 2,\ldots,k$ the system of the 2k-2 vectors

$$\frac{\partial^2 f(a)}{(\partial x^1)^2}, \ldots, \frac{\partial^2 f(a)}{\partial x^1 \partial x^{i-1}}, \frac{\partial^2 f(a)}{\partial x^1 \partial x^{i+1}}, \ldots, \frac{\partial^2 f(a)}{\partial x^1 \partial x^k},$$

$$\frac{\partial f(a)}{\partial x^2}, \ldots, \frac{\partial f(a)}{\partial x^k}$$

is linearly independent. In the case $k = 2$ the irregular point a is called non-degenerated, if it holds (C_1) : The vectors $\frac{\partial^2 f(a)}{(\partial x^1)^2}$ and $\frac{\partial f(a)}{\partial x^2}$ are linearly independent, or if it holds a more complicated condition (C_2). It is shown that this definition of nondegeneration with respect to the choice of the local coordinate system is invariant. The mapping f is

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Typical Irregularities for a Mapping of a k-dimensional Differentiable Manifold into a (2k-2)-dimensional Vector Space SOV/39-45-3-3/7

called non-degenerated, if all its irregular points are non-degenerated and if for k = 2 the boundary M^{k-1} of M^k contains no irregular points which satisfy (C_2) .

Main results : In every neighborhood of the class m of the mapping f there exists a non-degenerated mapping g. The set of all non-degenerated mappings of class m forms an everywhere dense domain in the space of all mappings of class m. If a is a non-degenerated irregular point of the mapping f, then there exists for each neighborhood U of a and for all sufficiently near mappings g an irregular point of the same type in the neighborhood of U. The set of the irregular points of a non-degenerated mapping forms a smooth one-dimensional manifold of class m - 1. For k = 2 in a certain neighborhood of an irregular point satisfying (C_2) there exists no further irregular point which satisfies the same condition (C_2).

The paper suggested by Pontryagin and guided by Boltyanskiy consists of 23 sections, presents a great deal of Whitney [Ref 3,4] and Sard [Ref 2] and is written in a way difficult to survey.

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Typical Irregularities for a Mapping of a k-dimensional Differentiable Manifold into a (2k-2)-dimensional Vector Space SOV/39-45-3-3/7

There are 4 references, 1 of which is Soviet, and 3 are American.

SUBMITTED: February 1, 1957

1. Mathematics--Theory 2. Topology--Applications 3. Tensor analysis

Card 4/4

STREMLINA, S.M., sanitarnyy vrach; DOBRUSHINA, S.M., sanitarnyy vrach

Case of "vanillism." Gig. i san., 21 no.7:52 Jl '56. (MLRA 9:9)

1. Iz sanitarno-epidemiologicheskoy stantsii Moskvy.
(VANILLA--TOXICOLOGY)

Dobrushinskiy M.O.

DOBRUSHINSKIY, M.O.

Acute hemolytic anemia. Vrach.delo supplement '57:8-9 (MIRA 11:3)

1. Chernovitskaya oblastnaya klinicheskaya bol'nitsa.
(ANEMIA)

DOBRUSHKIN, D.B.; FADDEYEV, B.V., kandidat tekhnicheskikh nauk.

New types of conveyor belts. Khim. prom. no.1:24-30 Ja-F '57.
(MLRA 10:4)

1. Sverdlovskiy zavod rezinovykh tekhnicheskikh izdeliy i Ural'skiy filial Akademii nauk SSSR.
(Conveying machinery)

FADDEYEV, B.V., kand.tekhn.nauk; DOBRUSHKIN, D.B., inzh.; MAMAYEV, K.N., inzh.

"Physical principles of the transmission of driving power by means of friction "by A.V.Andreev. Reviewed by B.V.Faddeev. Izv. vys. ucheb. zav.; gro. zhur. no.11:131-132 1959. (MIRA 14:5)
(Conveying machinery—Transmission devices)
(Andreev, A. V.)

√ 4048. Apparatus for [illegible]
Sverdlovsk Rubber [illegible]

[illegible]
[illegible]
Tekhnicheskikh [illegible] 1956, No. 5, 25 [illegible]
Rezina, 1957, 16, No. 2, 89 [illegible]

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000410710003-5"

S/138/62/000/001/004/009
A051/A126

AUTHORS: Dobrushkin, D.B.; Ekel', Ye.S.; Orlov, Z.D.

TITLE: The construction of rubber-metal valves

PERIODICAL: Kauchuk i rezina, no. 1, 1962, 11 - 15

TEXT: Four variations of the more frequently used designs of rubber-metal valves are described. Rubber-metal valves are said to ensure optimum conditions of hermetic sealing for working pressure in the formation of a closed rubber-seat contour. Methods are recommended for determining the profile of the seat, which, in turn, ensures the formation of a closed contour. The working principle of all 4 valves is as follows: the seat is submerged in the rubber deforming it and touching part of its surface where so-called contact tensions occur. The submerging depth of the seat must be arbitrarily chosen, regardless of the method used to determine the profile of the seat. The authors then give the mathematical determination of various parameters. There are 7 figures and 7 Soviet-bloc references.

ASSOCIATION: Sverdlovskiy filial nauchno-issledovatel'skogo instituta rezinovoy promyshlennosti (Sverdlovsk Branch of the Scientific Research Institute of the Rubber Industry)

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