

dimension lattices, Trans. Amer. Soc., to appear (Theorem 4), and condition (4) of the second theorem in Abstract 583-34, these Notices, October, 1961. The theorem has been proved for complemented modular lattices by Amemiya and Halperin (Canad. J. Math. 11 (1959), 485). (Received March 4, 1963.)

601-36. A. E. HURD, Massachusetts Institute of Technology, Cambridge, Massachusetts. Measure space homomorphisms and point transformations.

Let  $(X, S, \mu)$  and  $(Y, T, \nu)$  be measure spaces, and let  $M$  and  $N$  be the Boolean rings of  $\mu$ - and  $\nu$ -measure zero in  $S$  and  $T$  respectively. Denote by  $S'$  and  $T'$  the Boolean quotient rings  $S/M$  and  $T/N$ . A measure space homomorphism  $\phi: (X, S, \mu) \rightarrow (Y, T, \nu)$  is a Boolean ring homomorphism from  $S'$  to  $T'$  which also satisfies the condition: if  $\{A_i' : i = 1, 2, \dots\}$  is a sequence in  $S'$  and  $A_i' \wedge A_j' = 0$  for all  $i$  and  $j$  then  $\phi(\bigvee_{i=1}^{\infty} A_i') = \bigvee_{i=1}^{\infty} \phi(A_i')$ . Here the notation  $\wedge$  and  $\vee$  have been used for the operations induced on  $S'$  and  $T'$  by the operations  $\cap$  and  $\cup$  in  $S$  and  $T$ . It is shown that, under quite general assumptions on the measure space  $(X, S, \mu)$ , a measure space homomorphism  $\phi$  can be considered as generated by a measurable point transformation  $\psi$  from a subset of  $Y$  to  $X$  in a natural way. If  $\phi$  is an isomorphism the mapping  $\psi$  can be chosen to be 1-1. This generalizes a work of von Neumann (Ann. of Math. 33 (1932), 574-586) and von Neumann and Halmos (Ann. of Math. 43 (1942), 332-350). (Received March 4, 1963.)

601-37. F. W. LAWVERE, 8030 Owensmouth Avenue, Canoga Park, California. The "group ring" of a small category. Preliminary report.

Let  $R$  be an associative ring with unity and let  $\mathcal{C}$  be any small category. Define  $R[\mathcal{C}]$  as the set of all  $R$ -valued functions  $b$  defined on the maps of  $\mathcal{C}$  such that for each object  $C \in \mathcal{C}$ ,  $\{u: (u)b \neq 0 \text{ and } C \text{ is the codomain of } u\}$  is finite, together with map-wise addition and the multiplication  $(u)(a \cdot b) = \sum_{x \circ y = u} (x)a \cdot (y)b$ . This gives a functor  $\mathcal{R}_1 \times \tilde{\mathcal{C}}_1 \rightarrow \mathcal{R}_1$  where  $\tilde{\mathcal{C}}_1$  is the category of all functors  $T$  between small categories such that  $|T|$  (the restriction to objects) is an isomorphism. For a monoid  $\mathcal{C}$  (a category with one object)  $R[\mathcal{C}]$  is the usual; for a preorder  $\mathcal{C}$  ( $\mathcal{C}$  has at most one map with given domain and codomain)  $R[\mathcal{C}]$  is a subring of a certain matrix ring (see Mitchell, Brown University dissertation (1960)). There are always diagonal maps  $R \rightarrow R^{|\mathcal{C}|} \rightarrow R[\mathcal{C}]$ , in  $\mathcal{R}_1$ . If  $\mathcal{A}_1^{(R)}$  denotes the category of  $R$ -modules and  $\mathcal{A}_1^{(R)\mathcal{C}}$  denotes the category of all functors  $\mathcal{C} \rightarrow \mathcal{A}_1^{(R)}$  and natural transformations, there is always a functor  $\Pi: \mathcal{A}_1^{(R)\mathcal{C}} \rightarrow \mathcal{A}_1^{(R)[\mathcal{C}]}$  which admits a retraction, and which is an isomorphism if the set of objects of  $\mathcal{C}$  is finite. For any  $\mathcal{C}$  and any  $A: \mathcal{C} \rightarrow \mathcal{A}_1^{(R)}$ ,  $\text{Hom}_{R[\mathcal{C}]}(R, A\Pi) = \varprojlim(A)$ . (Received March 4, 1963.)

601-38. W. H. MILLS, Yale University, New Haven, Connecticut. Polynomials with minimal value sets.

Let  $k$  be a finite field of characteristic  $p$  that contains exactly  $q$  elements,  $q = p^n$ . Let  $F(x)$  be a polynomial in one variable over  $k$  of degree  $d$ , and let  $r + 1$  denote the number of distinct values  $F(\mu)$  as  $\mu$  ranges over  $k$ . It is almost immediate that  $r \geq [(q - 1)/d]$ . Carlitz, Lewis, Mills, and Straus [Mathematika 8 (1961), 121-130] raised the question of the determination of all polynomials

# ERRATA

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A. BERIN. Transformation of power series. Page 269, Abstract 601-5.

Line 7. For " $\sum_{m=1}^{\infty} (-1)^{m-1} (\Delta^{m-1} a_1) (x-1)^m$ " read  
" $\sum_{m=1}^{\infty} (-1)^{m-1} (\Delta^{m-1} a_1) / (z-1)^m$ ".

F. W. LAWVERE. The "group ring" of a small category. Preliminary report.  
Page 280, Abstract 601-37.

Last sentence should read: "For every  $\mathcal{C}$  there is an  $R[\mathcal{C}]$ -module  $Q$  such that for all  $A: \mathcal{C} \rightarrow \mathcal{A}^{(R)}$  one has  $\varprojlim_{\mathcal{C}} (A) \cong \text{Hom}_{R[\mathcal{C}]}(Q, A\Pi)$ ."

J. A. WOLF. The differentiable fibre bundle associated to a complete map. Page 291,  
Abstract 63T-135.

The results asserted are not correct; in the proof it was erroneously assumed that a semigroup homomorphism is open. The following result is salvaged.

Theorem. Let  $\pi: E \rightarrow B$  be a differentiable map of connected paracompact manifolds. Then the following conditions are equivalent. (i)  $\pi: E \rightarrow B$  is a locally trivial differentiable fibre space. (ii)  $\pi: E \rightarrow B$  is the fibre space underlying a differentiable fibre bundle with topological structure group. (iii)  $\pi$  is of rank  $\dim B$ , and  $E$  and  $B$  admit complete Riemannian metrics for which  $\pi$  is complete (see Abstract 63T-135 for definition). (iv)  $\pi$  is of rank  $\dim B$ ; given a complete Riemannian metric on  $B$ , there is a complete Riemannian metric on  $E$  for which  $\pi$  is complete.

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