



## PRESERVERS OF TERM RANKS AND STAR COVER NUMBERS OF SYMMETRIC MATRICES\*

LEROY B. BEASLEY<sup>†</sup>

**Abstract.** Let  $\mathcal{S}_n(\mathbb{S})$  denote the set of symmetric matrices over some semiring,  $\mathbb{S}$ . A line of  $A \in \mathcal{S}_n(\mathbb{S})$  is a row or a column of  $A$ . A star of  $A$  is the submatrix of  $A$  consisting of a row and the corresponding column of  $A$ . The term rank of  $A$  is the minimum number of lines that contain all the nonzero entries of  $A$ . The star cover number is the minimum number of stars that contain all the nonzero entries of  $A$ . This paper investigates linear operators that preserve sets of symmetric matrices of specified term rank and sets of symmetric matrices of specific star cover numbers. Several equivalences to the condition that  $T$  preserves the term rank of any matrix are given along with characterizations of a couple of types of linear operators that preserve certain sets of matrices defined by the star cover number that do not preserve all term ranks.

**Key words.** Semiring, Semimodule, Upper ideal, Linear preserver, Term rank, Star cover number.

**AMS subject classifications.** 05C50, 15A86.

---

\*Received by the editors on February 23, 2016. Accepted for publication on June 3, 2016.  
Handling Editor: Zejun Huang.

<sup>†</sup>Department of Mathematics and Statistics, Utah State University, Logan, Utah 84322-3900,  
USA (leroy.b.beasley@aggiemail.usu.edu).