

## Universal Partial Words

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Given a non-empty alphabet  $A$  with  $\diamond \notin A$ . A *partial word* of length  $n$  is  $u = u_1u_2 \dots u_n$  where  $u_i \in A \cup \{\diamond\}$  for  $1 \leq i \leq n$ . We think of  $\diamond$  as a ‘wildcard’ which can correspond to any character in  $A$ .  $A^n$  is the set of all words of length  $n$  over  $A$ . A *universal partial word* or *upword* for  $A^n$  is a partial word containing each word of  $A^n$  exactly once. We investigate the existence of upwords for both binary and non-binary alphabets.