Source task and conventions

Construct nonempty binary divisibility DFAs for 4 and 5 and prove the minimal state count for a general positive modulus $n = a2^b$ with odd a.

Conventional solution and proof

After a prefix of numeric value v, appending bit c gives $2v + c$. Thus the standard remainder transition is $r \mapsto 2r + c \pmod{n}$. For four, merge odd remainders and use states Z (zero, accepting), O (odd) and T