The Theory of Computation

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Solution Manual

Chapter 5, Additional Problem 5.6

Let c_A be the characteristic equation of A. Then $f^{-1}(A)$ has characteristic equation $c_A \cdot f$, since we need only map the element through f and ask if the result is in A. Since F is total, so is $c_A \cdot F$, so we are done.

We can enumerate $f(A)$ by the simple expedient of running f on A; that is, $f \cdot c_A$ has $f(A)$ has its range; since $f \cdot c_A$ is a recursive function, its range is r.e.

B is known to be r.e. Let ϕ_B be a function with $ran\phi_B = B$; then note that the function $f \cdot \phi_B$ has range $f(B)$, so that $f(B)$ is r.e. Finally, let ψ_B be a function with $dom\psi_B = B$; then note that the function $\psi_B \cdot f$ has domain $f^{-1}(B)$, which is thus r.e.