Definition: A **predicate** is a function from a given set (domain) to $\{T, F\}$.

A predicate can be applied, or **evaluated** at, an element of the domain.

Two predicates over the same domain are **equivalent** means they evaluate to the same truth values for all possible assignments of domain elements to the input.

Input	Output		
	$P(x)$	$N(x)$	$Mystery(x)$
x	$[x]_{2c,3} > 0$	$[x]_{2c,3} < 0$	
000	F		T
001	T		T
010	T		T
011	T		F
100	F		F
101	F		T
110	F		F
111	F		T

Input	$E(x)$	$L(x)$	$M(x)$
			Note: $256 = 2^8$
x	"$(x)_2$ is even"	"$(x)_2 < 3$"	"$(x)_2 > 256$"
1	F	T	F
10	T	T	F
11	F	F	F
100	T	F	F
101	F	F	F
110	T	F	F
...	...	...	...

No last row!

The domain for each of the predicates $P(x)$, $N(x)$, $Mystery(x)$ is ______________________________.

Extra example:

The domain for each of the predicates $E(x)$, $L(x)$, $M(x)$ is _________________________________.

Definition: The **truth set** of a predicate is the collection of all elements in its domain where the predicate evaluates to T.

The truth set for the predicate $P(x)$ is _________________________.

The truth set for the predicate $N(x)$ is ______________________.

The truth set for the predicate $Mystery(x)$ is ____________________________________.

Extra example:

Three (distinct) elements in the truth set of $E(x)$ are __________________.

Three (distinct) elements in the truth set of $L(x)$ are __________________.

Three (distinct) elements in the truth set of $M(x)$ are ________________________.

Definitions (Rosen 40-45):
The **universal quantification** of $P(x)$ is the statement "$P(x)$ for all values of x in the domain" and is written $\forall x P(x)$. An element for which $P(x) = F$ is called a **counterexample** of $\forall x P(x)$.

The **existential quantification** of $P(x)$ is the statement "There exists an element x in the domain such that $P(x)$" and is written $\exists x P(x)$. An element for which $P(x) = T$ is called a **witness** of $\exists x P(x)$.

Example: ________________ is a true existential quantification.

Statements involving predicates and quantifiers are **logically equivalent** means they have the same truth value no matter which predicates (domains and functions) are substituted in.

Quantifier version of De Morgan's laws: $\neg \forall x P(x) \equiv \exists x (\neg P(x))$ $\qquad$ $\neg \exists x Q(x) \equiv \forall x (\neg Q(x))$

Example: _______________ is a false universal quantification. It is logically equivalent to ________________

Recall: Each RNA strand is a string whose symbols are elements of the set $B = \{\texttt{A}, \texttt{C}, \texttt{G}, \texttt{U}\}$. The **set of all RNA strands** is called S. The function *rnalen* that computes the length of RNA strands in S is:

		$rnalen : S$	$\to \mathbb{Z}^+$
Basis Step:	If $b \in B$ then	$rnalen(b)$	$= 1$
Recursive Step:	If $s \in S$ and $b \in B$, then	$rnalen(sb)$	$= 1 + rnalen(s)$

Example predicates on S

$H(s) = T$	Truth set of H is ______________
$L_3(s) = \begin{cases} T & \text{if } rnalen(s) = 3 \\ F & \text{otherwise} \end{cases}$	Strand where L_3 evaluates to T is e.g.________ Strand where L_3 evaluates to F is e.g. ________
$F_{\texttt{A}}$ is defined recursively by: Basis step: $F_{\texttt{A}}(\texttt{A}) = T$, $F_{\texttt{A}}(\texttt{C}) = F_{\texttt{A}}(\texttt{G}) = F_{\texttt{A}}(\texttt{U}) = F$ Recursive step: If $s \in S$ and $b \in B$, then $F_{\texttt{A}}(sb) = F_{\texttt{A}}(s)$	Strand where $F_{\texttt{A}}$ evaluates to T is e.g.________ Strand where $F_{\texttt{A}}$ evaluates to F is e.g. ________
$P_{\texttt{AUC}}$ is defined as the predicate whose truth set is the collection of RNA strands where the string AUC is a substring (appears inside s, in order and consecutively)	Strand where $P_{\texttt{AUC}}$ evaluates to T is e.g.________ Strand where $P_{\texttt{AUC}}$ evaluates to F is e.g. ________