Interpreter Programming Project
CS 3361 Concepts of Programming Languages

Below is the syntax and semantics for a single Boolean expression followed by
a period. Write a program which prompts the user to input a file name which
contains the Boolean expression or simply to input the string to be checked
(indicate which input method you will use in your comments). You may assume
that no input will be longer than 100 characters in length. Expressions may
contain white spaces and white spaces should be considered to be delimiters
(i.e. a white space between the $-$ and $>$ of the implication symbol would be a
syntax error). The program should check if the expression in the file is of valid
syntax and (if valid) compute the value of the expression. The output should
either be an error message or a a message that gives the value of the expression.
**You must use the techniques taught in the class this is a recursive
descent interpreter.**

Syntax: (note: for $\vee$ use the lowercase letter "v" and for $\wedge$ use the caret symbol)

			Selection Sets
$\langle B \rangle$	$::=$	$\langle IT \rangle$.	$\{\sim, T, F, (\}$
$\langle IT \rangle$	$::=$	$\langle OT \rangle \, \langle IT\_Tail \rangle$	$\{\sim, T, F, (\}$
$\langle IT\_Tail \rangle$	$::=$	$- > \; \langle OT \rangle \, \langle IT\_Tail \rangle$	$\{->\}$
	$::=$	ε	$\{.,)\}$
$\langle OT \rangle$	$::=$	$\langle AT \rangle \, \langle OT\_Tail \rangle$	$\{\sim, T, F, (\}$
$\langle OT\_Tail \rangle$	$::=$	$\vee \, \langle AT \rangle \, \langle OT\_Tail \rangle$	$\{\vee\}$
	$::=$	ε	$\{->, .,)\}$
$\langle AT \rangle$	$::=$	$\langle L \rangle \, \langle AT\_Tail \rangle$	$\{\sim, T, F, (\}$
$\langle AT\_Tail \rangle$	$::=$	$\wedge \, \langle L \rangle \, \langle AT\_Tail \rangle$	$\{\wedge\}$
	$::=$	ε	$\{\vee, ->, .,)\}$
$\langle L \rangle$	$::=$	$\langle A \rangle$	$\{T, F, (\}$
	$::=$	$\sim \langle L \rangle$	$\{\sim\}$
$\langle A \rangle$	$::=$	T	$\{T\}$
	$::=$	F	$\{F\}$
	$::=$	$(\; \langle IT \rangle \;)$	$\{(\}$

Syntactic Domains:
$\langle B \rangle$: Bool_stmt
$\langle IT \rangle$: Imply_term
$\langle OT \rangle$: Or_term
$\langle AT \rangle$: And_term
$\langle IT\_Tail \rangle$: Imply_tail
$\langle OT\_Tail \rangle$: Or_tail
$\langle AT\_Tail \rangle$: And_tail
$\langle L \rangle$: Literal
$\langle A \rangle$: Atom

Semantic Domain:
$b = \{T.F\}$ (Boolean values True and False)

Semantic Function Domains:
$\alpha : \text{Bool\_stmt} \rightarrow b$
$\beta : \text{Imply\_term} \rightarrow b$
$\delta : \text{Or\_term} \rightarrow b$
$\gamma : \text{And\_term} \rightarrow b$
$\lambda : b \times \text{Imply\_tail} \rightarrow b$
$\mu : b \times \text{Or\_tail} \rightarrow b$
$\eta : b \times \text{And\_tail} \rightarrow b$
$\phi : \text{Literal} \rightarrow b$
$\psi : \text{Atom} \rightarrow b$

Semantic Equations:
$\alpha(\ll \langle IT \rangle . \gg) = \beta(\ll \langle IT \rangle \gg)$
$\beta(\ll \langle OT \rangle \langle IT\_Tail \rangle \gg) = \lambda(\delta(\ll \langle OT \rangle \gg), \ll \langle IT\_Tail \rangle \gg)$
$\delta(\ll \langle AT \rangle \langle OT\_Tail \rangle \gg) = \mu(\gamma(\ll \langle AT \rangle \gg), \ll \langle OT\_Tail \rangle \gg)$
$\gamma(\ll \langle L \rangle \langle AT\_Tail \rangle \gg) = \eta(\phi(\ll \langle L \rangle \gg), \ll \langle AT\_Tail \rangle \gg)$
$\lambda(b, \varepsilon) = b \text{ (where } b \in \{T, F\})$
$\lambda(F, \ll - > \langle OT \rangle \langle IT\_Tail \rangle \gg) = \lambda(T, \ll \langle IT\_Tail \rangle \gg)$
$\lambda(T, \ll - > \langle OT \rangle \langle IT\_Tail \rangle \gg) = \lambda(\delta(\ll \langle OT \rangle \gg), \ll \langle IT\_Tail \rangle \gg)$
$\mu(b, \varepsilon) = b \text{ (where } b \in \{T, F\})$
$\mu(T, \ll \vee \langle AT \rangle \langle OT\_Tail \rangle \gg) = T$
$\mu(F, \ll \vee" \langle AT \rangle \langle OT\_Tail \rangle \gg) = \mu(\gamma(\ll \langle AT \rangle \gg), \ll \langle OT\_Tail \rangle \gg)$
$\eta(b, \varepsilon) = b \text{ (where } b \in \{T, F\})$
$\eta(F, \ll \wedge \langle L \rangle \langle AT\_Tail \rangle \gg) = F$
$\eta(T, \ll \wedge \langle L \rangle \langle AT\_Tail \rangle \gg) = \eta(\phi(\ll \langle L \rangle \gg), \ll \langle AT\_Tail \rangle \gg)$
$\phi(\ll \sim \langle L \rangle \gg) = \text{if } \phi(\ll \langle L \rangle \gg) = T \text{ then } F \text{ else if } \phi(\ll \langle L \rangle \gg) = F \text{ then } T$
$\phi(\ll \langle A \rangle \gg) = \psi(\ll \langle A \rangle \gg)$
$\psi(\ll T \gg) = T$
$\psi(\ll F \gg) = F$
$\psi(\ll (\langle IT \rangle) \gg) = (\beta(\ll \langle IT \rangle \gg))$