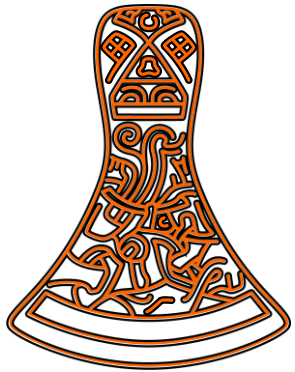
DYALOG

Glasgow 2024

New Function for Shell Calls



Peter Mikkelsen

Introduction

- Overview of ⍞SHELL
- An improved version of ⍞SH/⍞CMD
  - More control over a lot of things
- Last year I explained the "why"
  - Design has changed a bit
  - More focus on what the system function can do this year

Why provide an alternative to ⍰SH?

- Short version: ⍰SH makes too many choices for us
  - If we disagree, there is no way to change them
- Examples:
  - Always picks up standard output as lines of text with specific encoding
  - Assumes non-zero exit codes are always bad
  - Blocks all other thread while it waits
- Difficult to extend ⍰SH enough, without breaking changes

□SHELL overview

- Monadic system function `R←□SHELL cmd`
  - `'Command arg1 arg2'` - run via system shell
  - `'Command' 'arg1' 'arg2'` - execute command directly
- Supports many variant options to change the defaults
- Result is a five-element nested vector
  - `(StreamData StreamIds ExitCode ExitReason Pid)`
  - More complicated, but `⊃⊃□SHELL` is almost equivalent

A look at the result

- `StreamData` and `StreamIds`
  - Vectors of the same length
- `SHELL` can collect output from different "streams"
  - Controllable via variant options
- Each collected stream has its number in `StreamIds`
- Data at the corresponding position of `StreamData`
  - Default is to redirect stderr (2) to stdout (1), and collect stdout

A look at the result

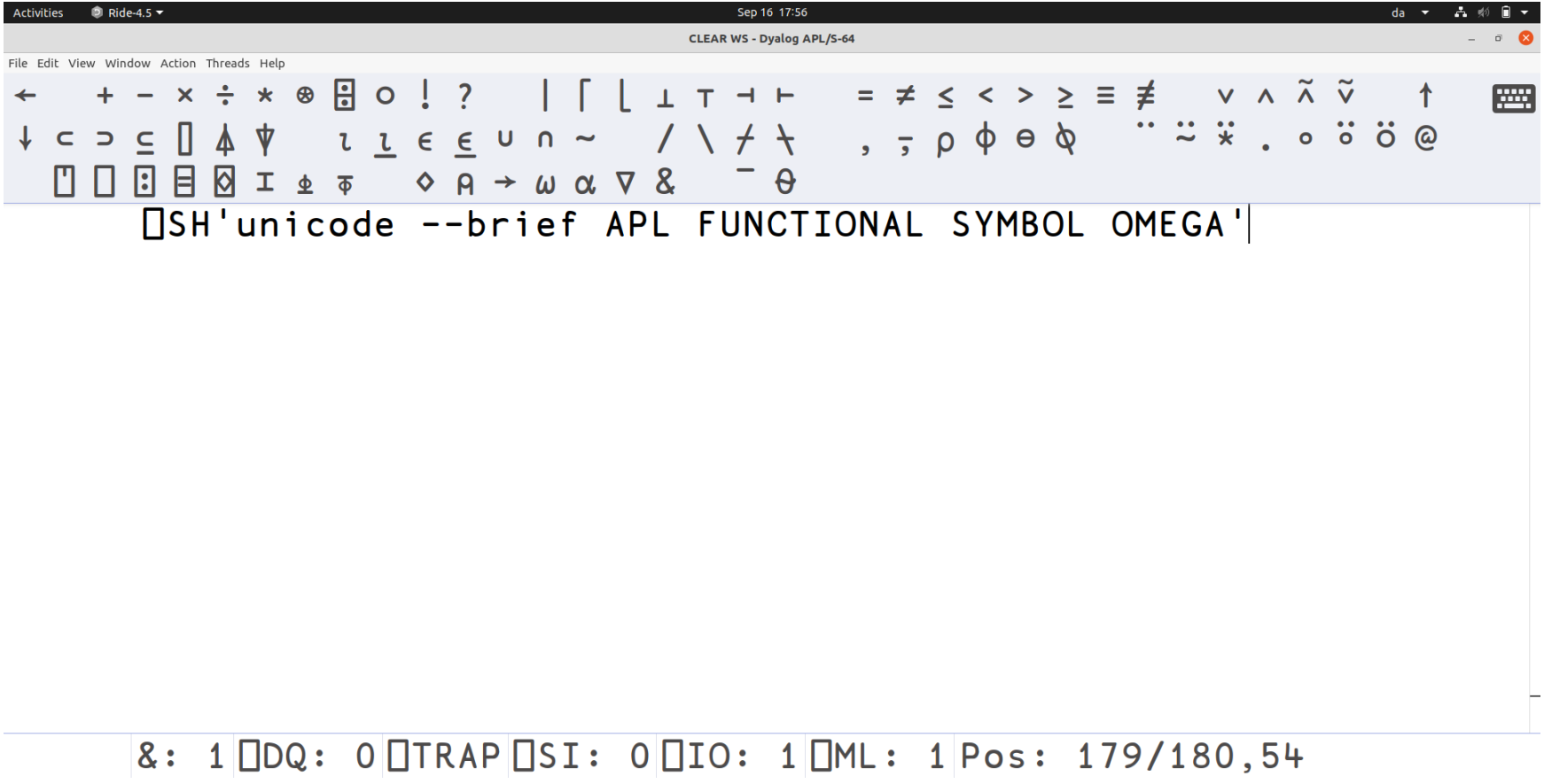
- `ExitCode` and `ExitReason`
  - Integers that tells us why ⎕`SHELL` stopped
- `ExitReasons`:
  - 0: normal exit. `ExitCode` is the exit code
  - 1: terminated by signal. `ExitCode` is the negated signal number
  - 2: ⎕`SHELL` timed out. `ExitCode` is always `¯1006`
  - 3: ⎕`SHELL` interrupted. `Exitcode` is always `¯1002`

A look at the result

- `Pid`
  - Process ID if the child process is still running
- This is only relevant when `ExitReason` is 2 or 3
- Additional cleanup might be required to get rid of the process
  - Some I-beams will be provided to help with that

Demo

- Let’s have a quick look in the session
- (Screenshots of the demo)



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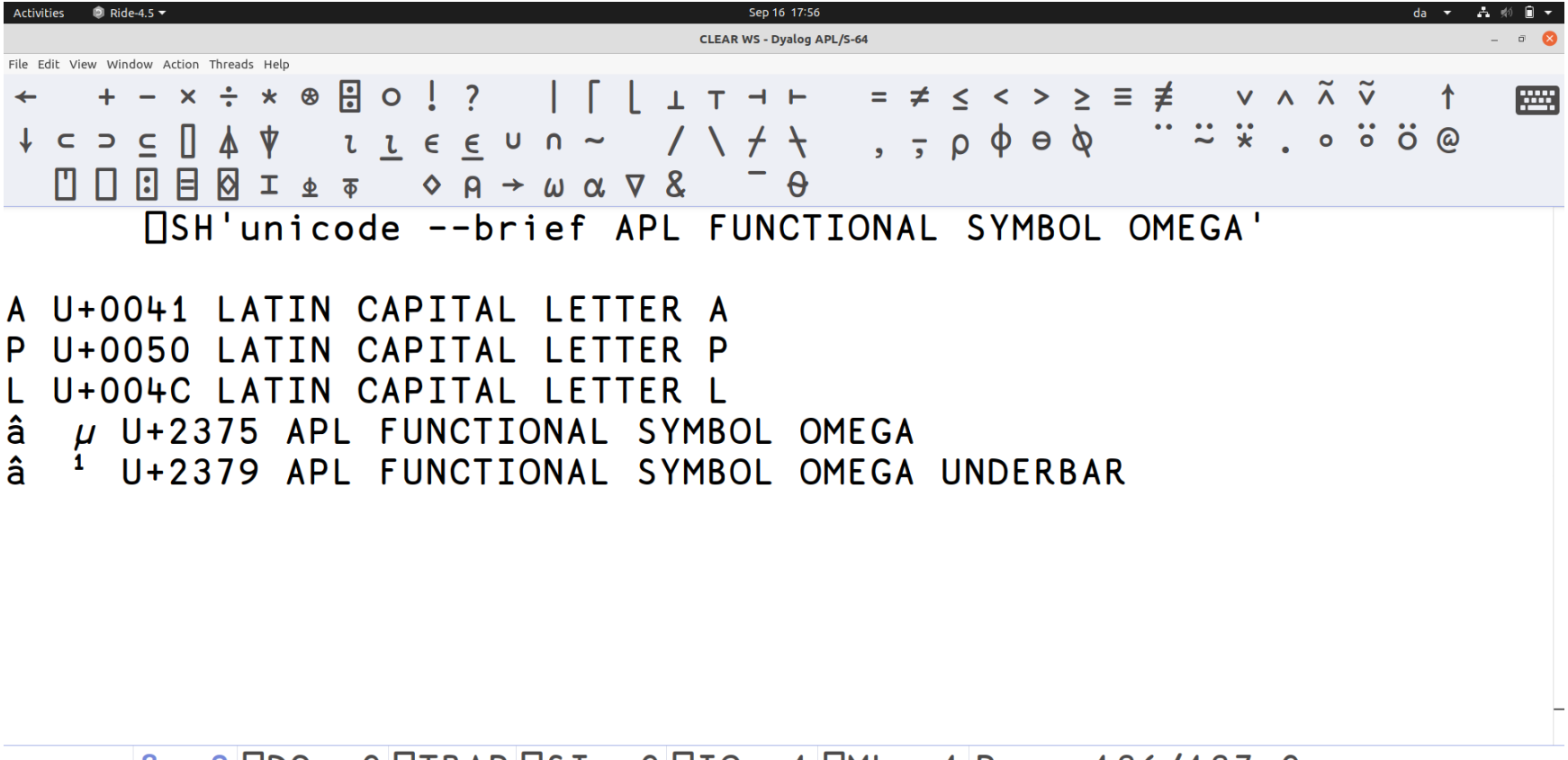

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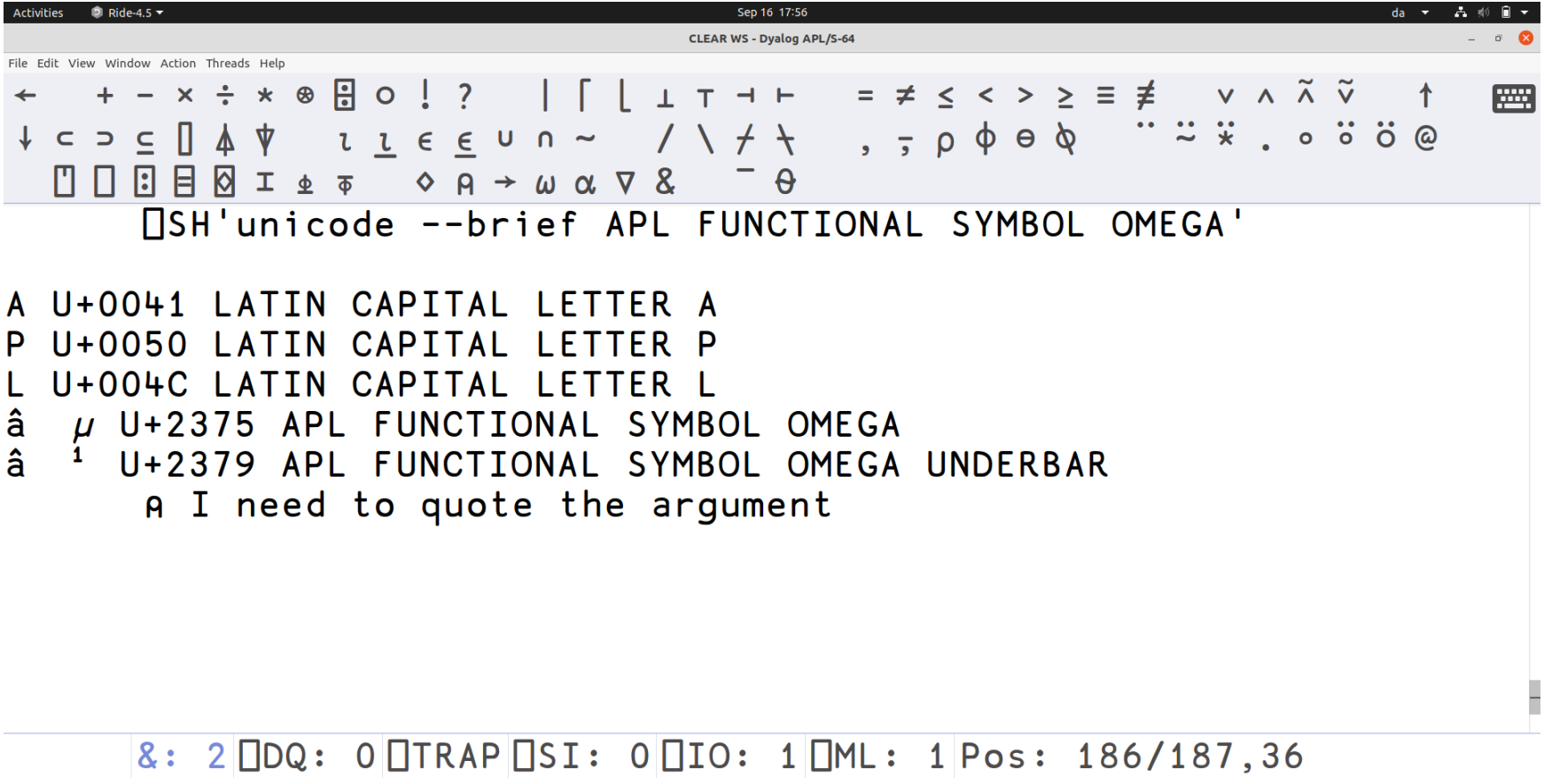
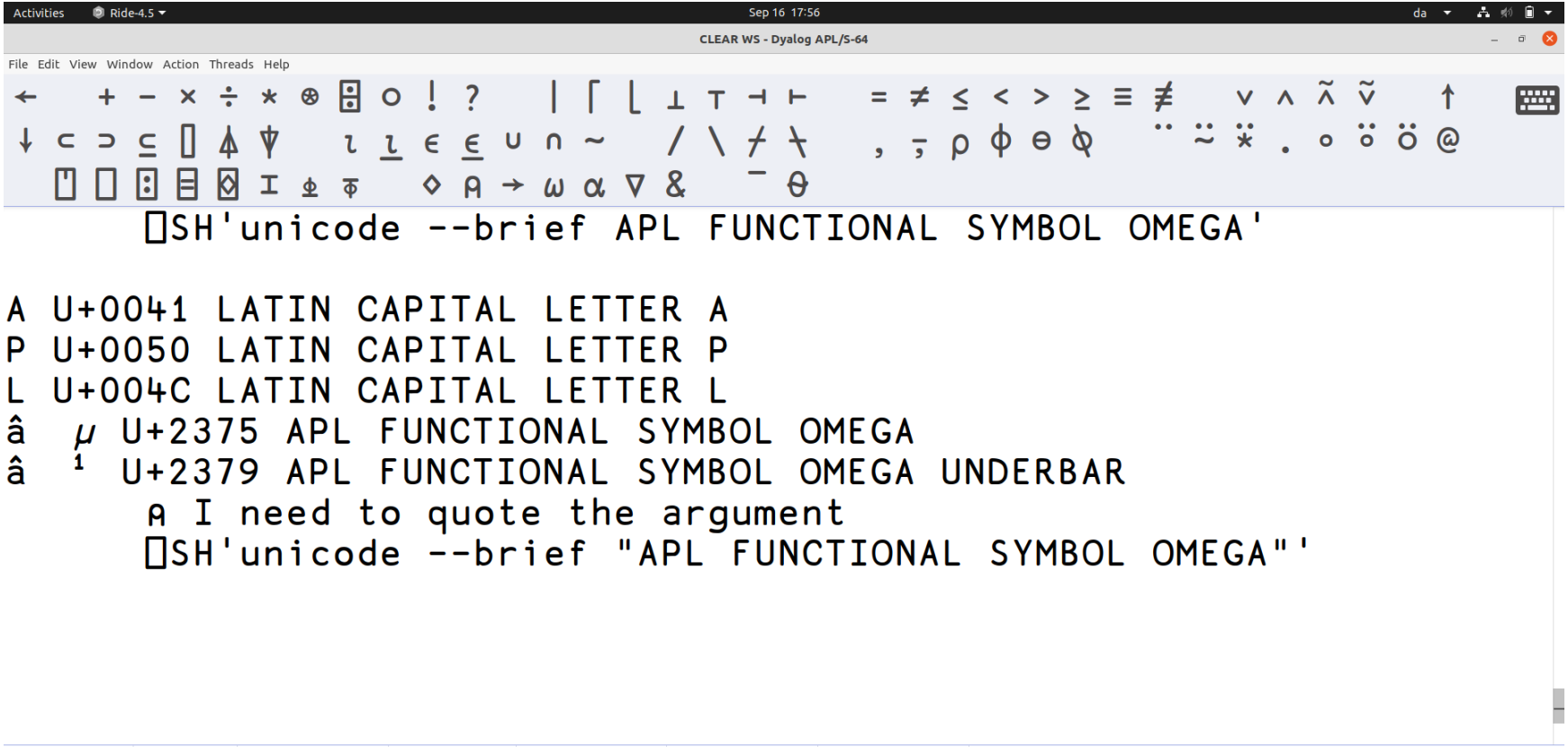

Activities
Ride-4.5
Sep 16 17:56
da
CLEAR WS - Dyalog APL/S-64
File Edit View Window Action Threads Help
⎕SH'unicode --brief APL FUNCTIONAL SYMBOL OMEGA'
A U+0041 LATIN CAPITAL LETTER A
P U+0050 LATIN CAPITAL LETTER P
L U+004C LATIN CAPITAL LETTER L
â μ U+2375 APL FUNCTIONAL SYMBOL OMEGA
â ¹ U+2379 APL FUNCTIONAL SYMBOL OMEGA UNDERBAR
⍝ I need to quote the argument
&: 2 ⎕DQ: 0 ⎕TRAP ⎕SI: 0 ⎕IO: 1 ⎕ML: 1 Pos: 186/187,36



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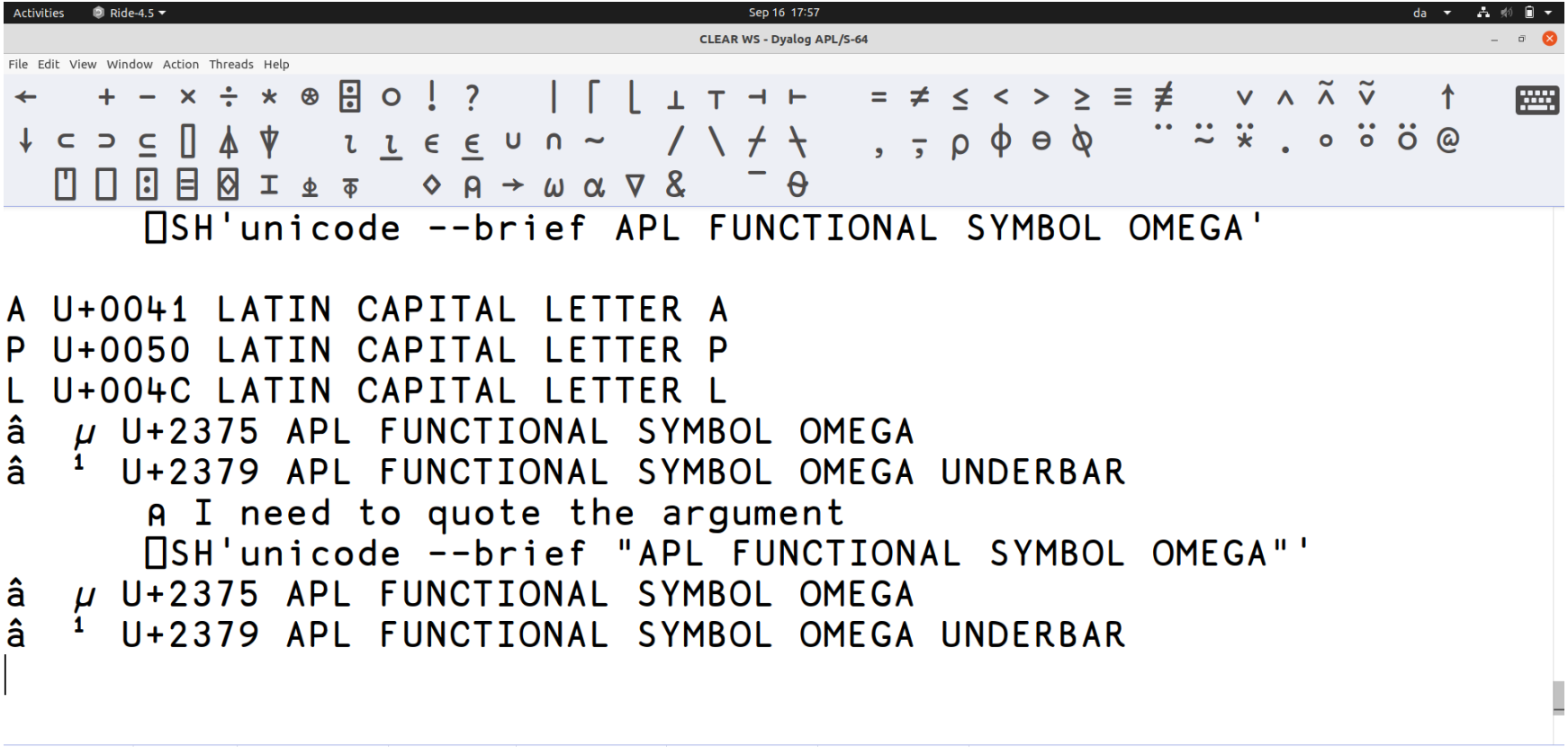

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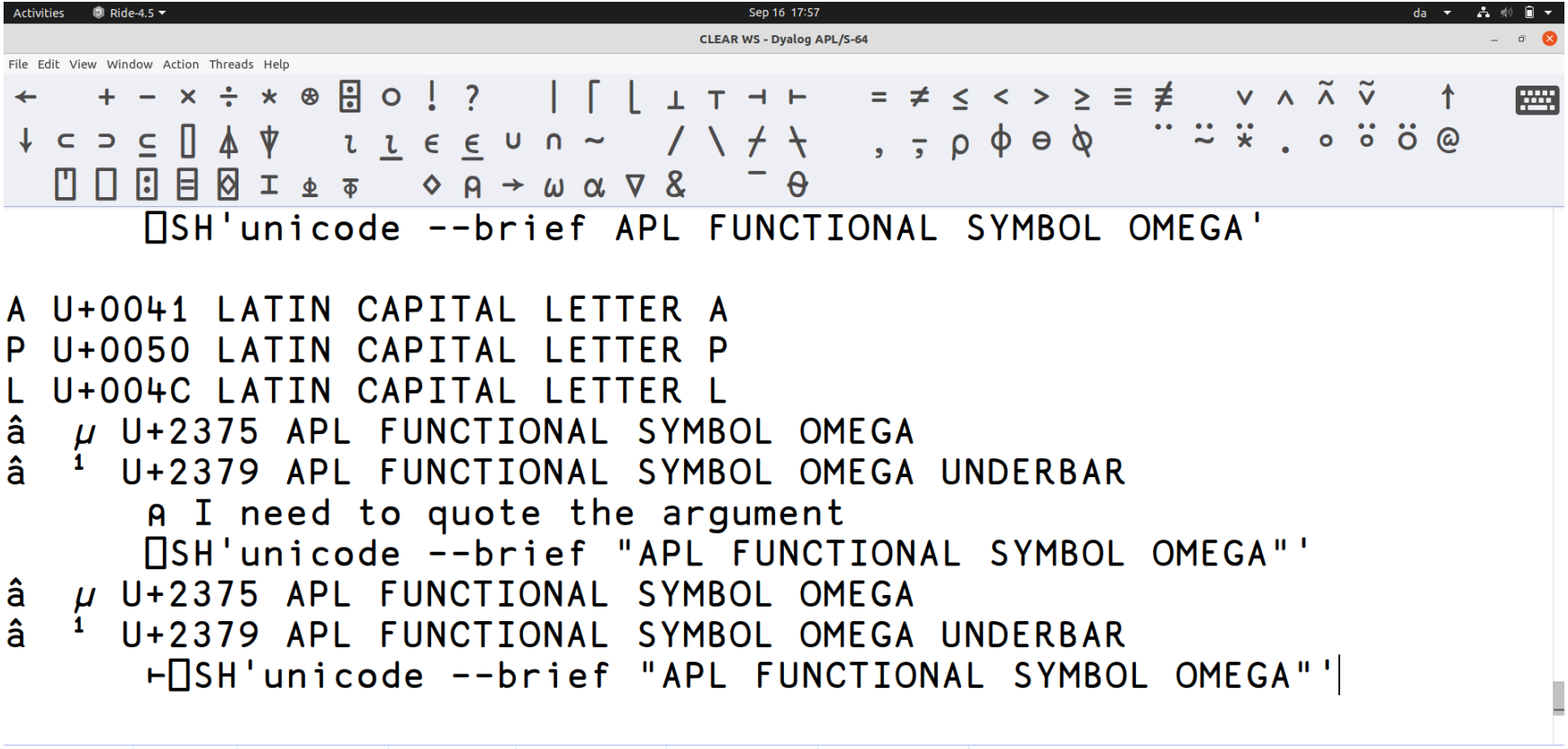

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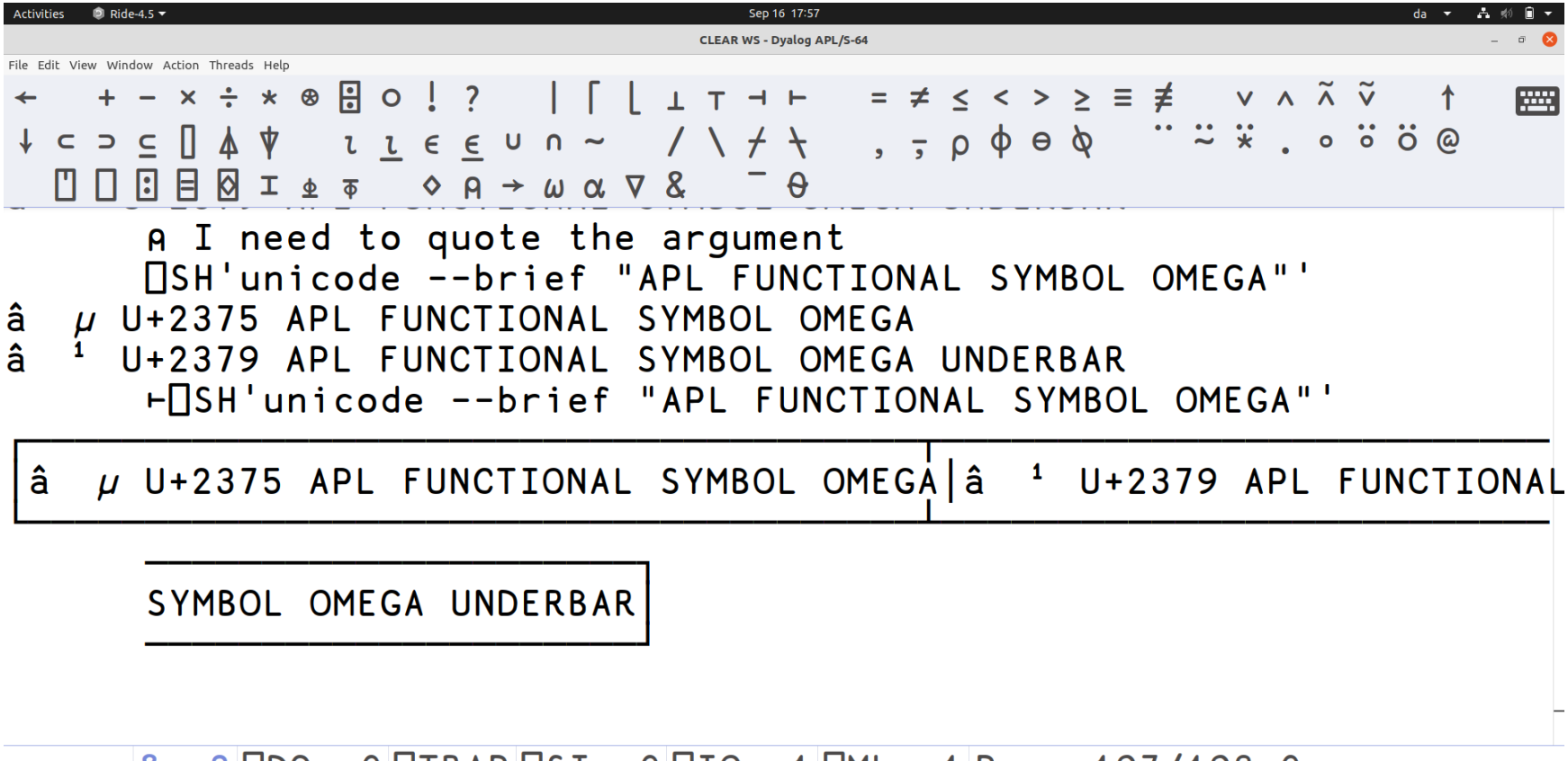

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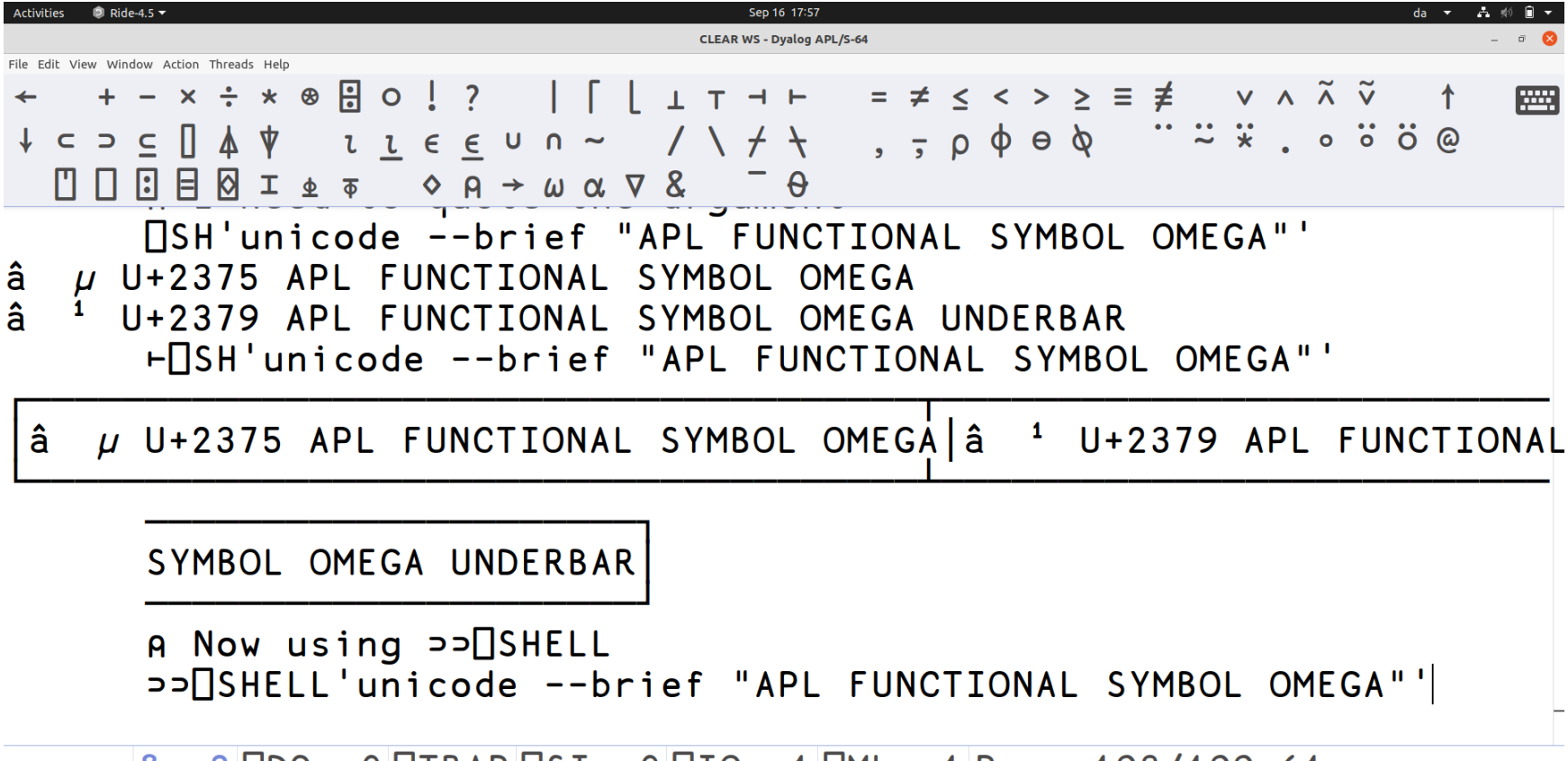

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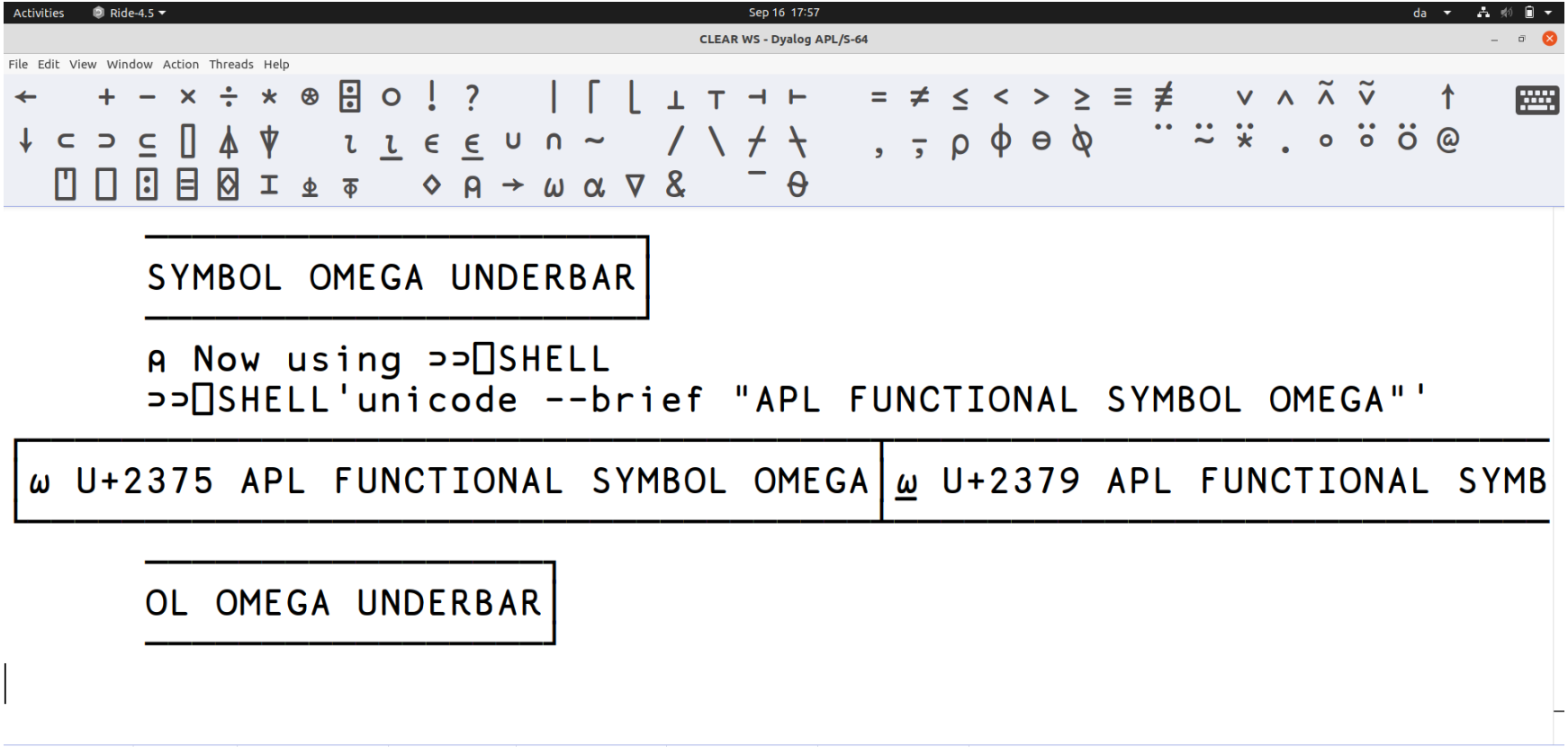

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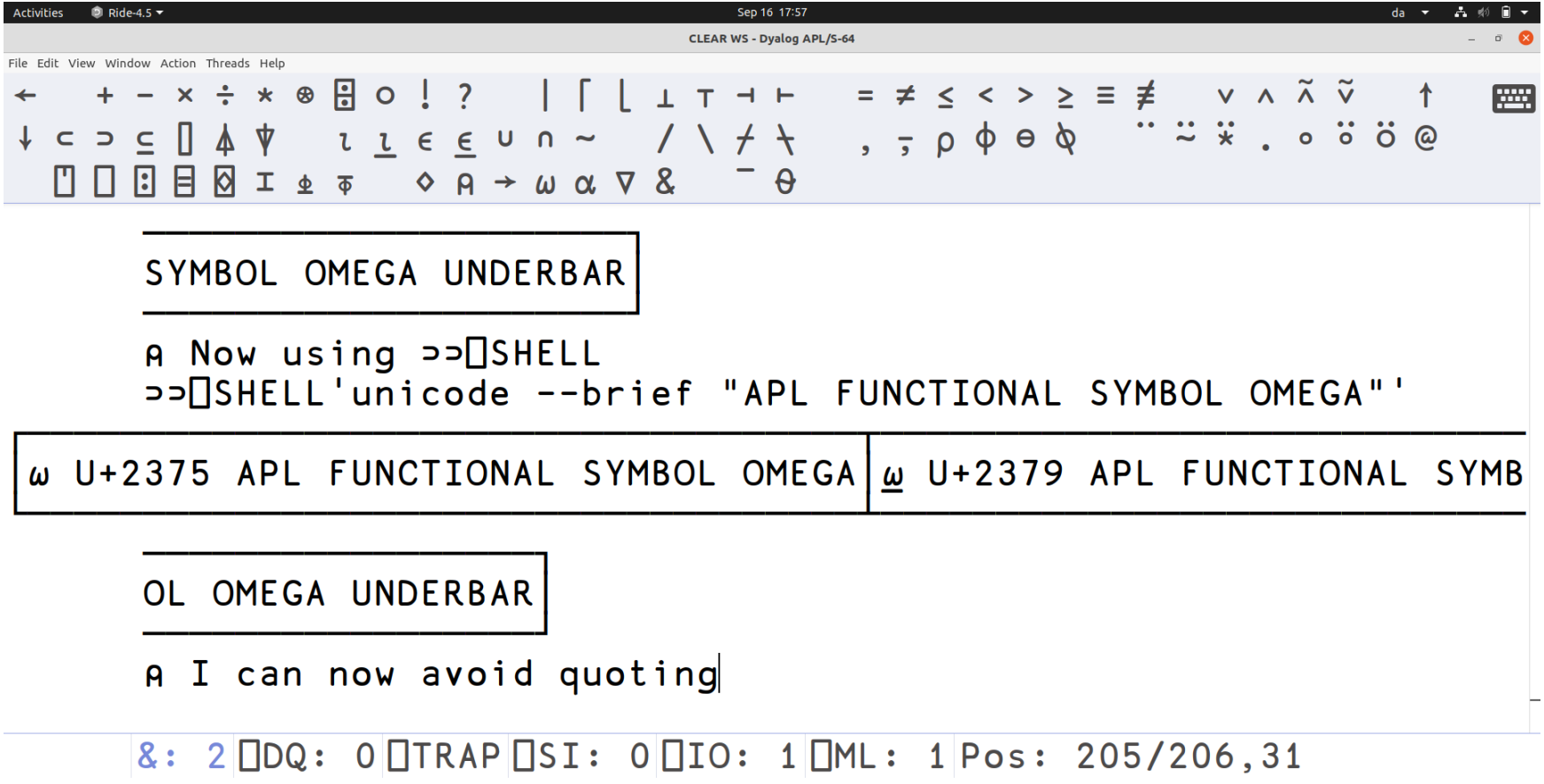
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Sep 16 17:57
da
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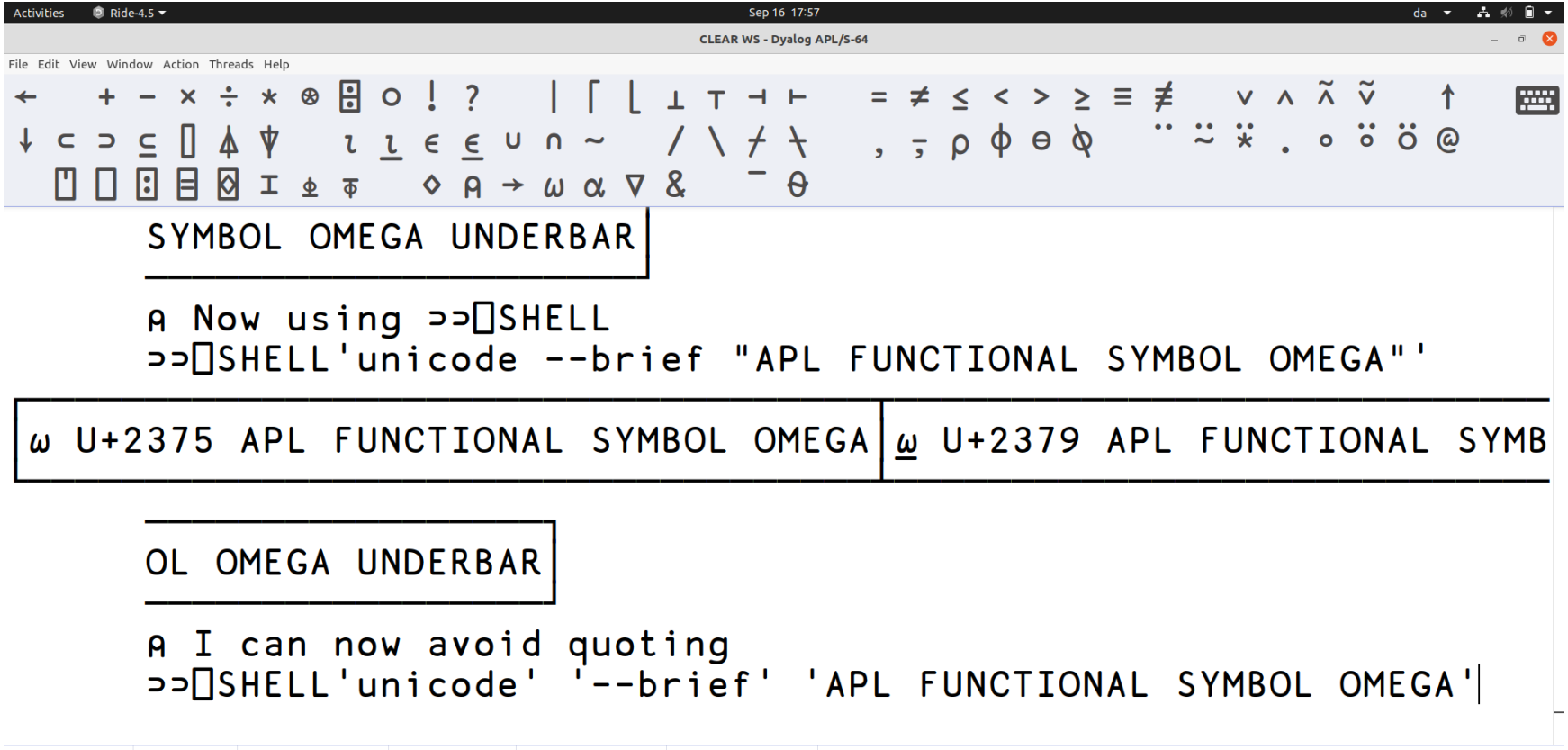
SYMBOL OMEGA UNDERBAR
⍝ Now using ⍝⍝⎕SHELL
⍝⍝⎕SHELL'unicode --brief "APL FUNCTIONAL SYMBOL OMEGA"'
ω U+2375 APL FUNCTIONAL SYMBOL OMEGA
ω̲ U+2379 APL FUNCTIONAL SYMB
OL OMEGA UNDERBAR
⍝ I can now avoid quoting
&: 2 ⎕DQ: 0 ⎕TRAP ⎕SI: 0 ⎕IO: 1 ⎕ML: 1 Pos: 205/206,31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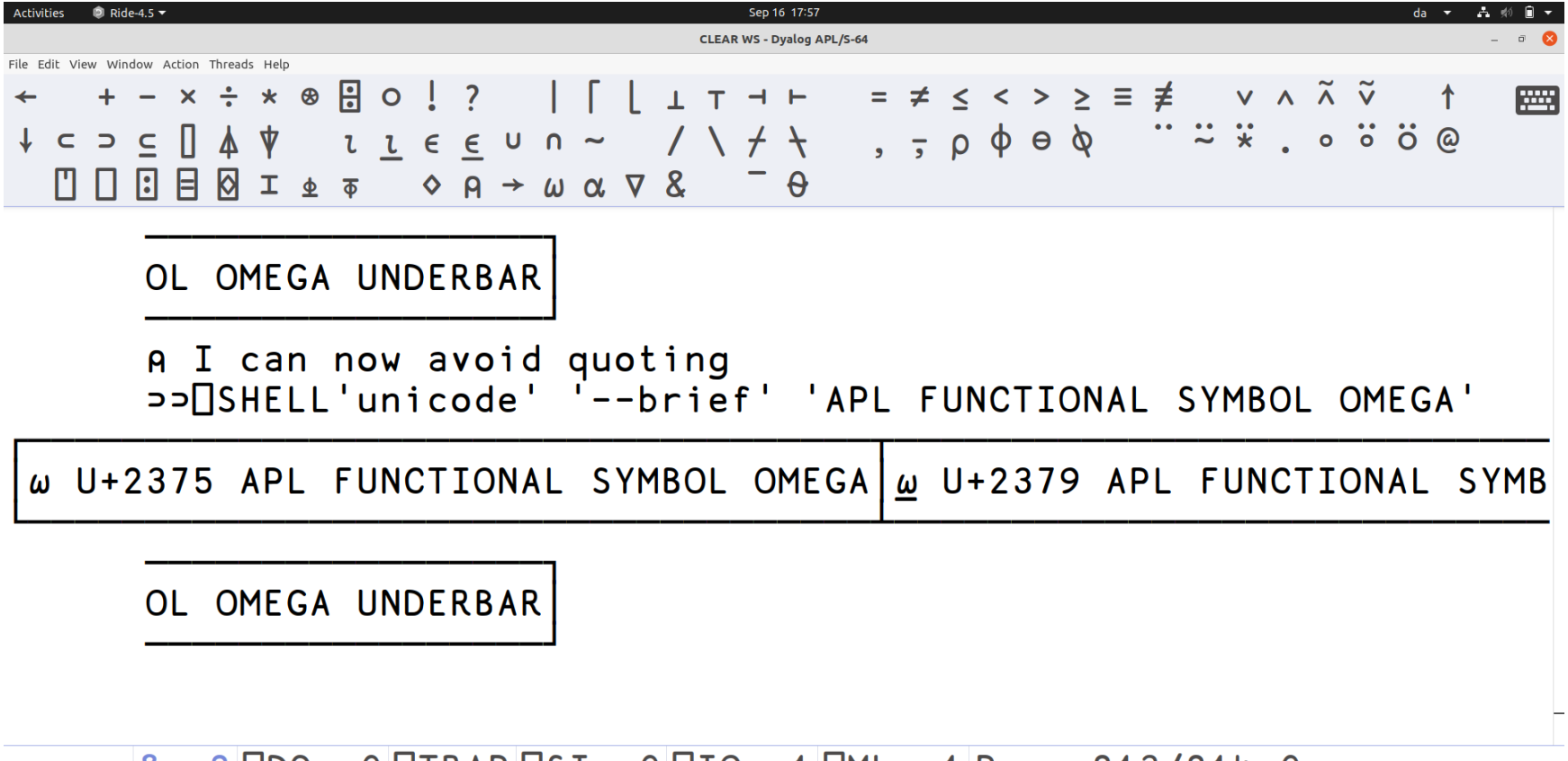

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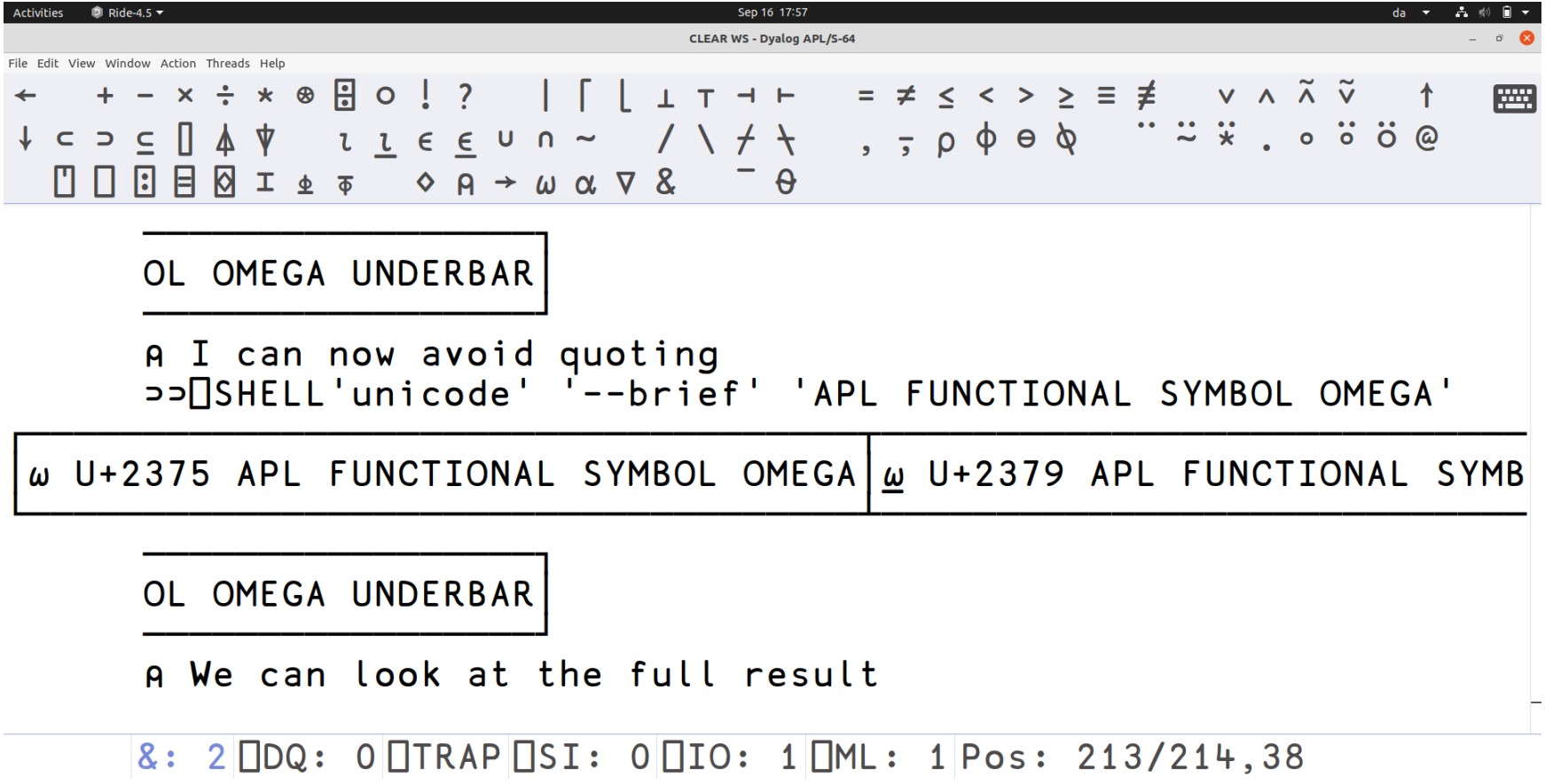


```
      ⎕OL OMEGA UNDERBAR
      ⍝ I can now avoid quoting
      ⍝ We can look at the full result
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      ⍝ We can look at the full result
      ⎕SHELL'unicode' '--brief' 'APL FUNCTIONAL SYMBOL OMEGA'
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ω̲ U+2379 APL FUNCTIONAL SYMB
      ⎕OL OMEGA UNDERBAR
      ⍝ We can look at the full result
```


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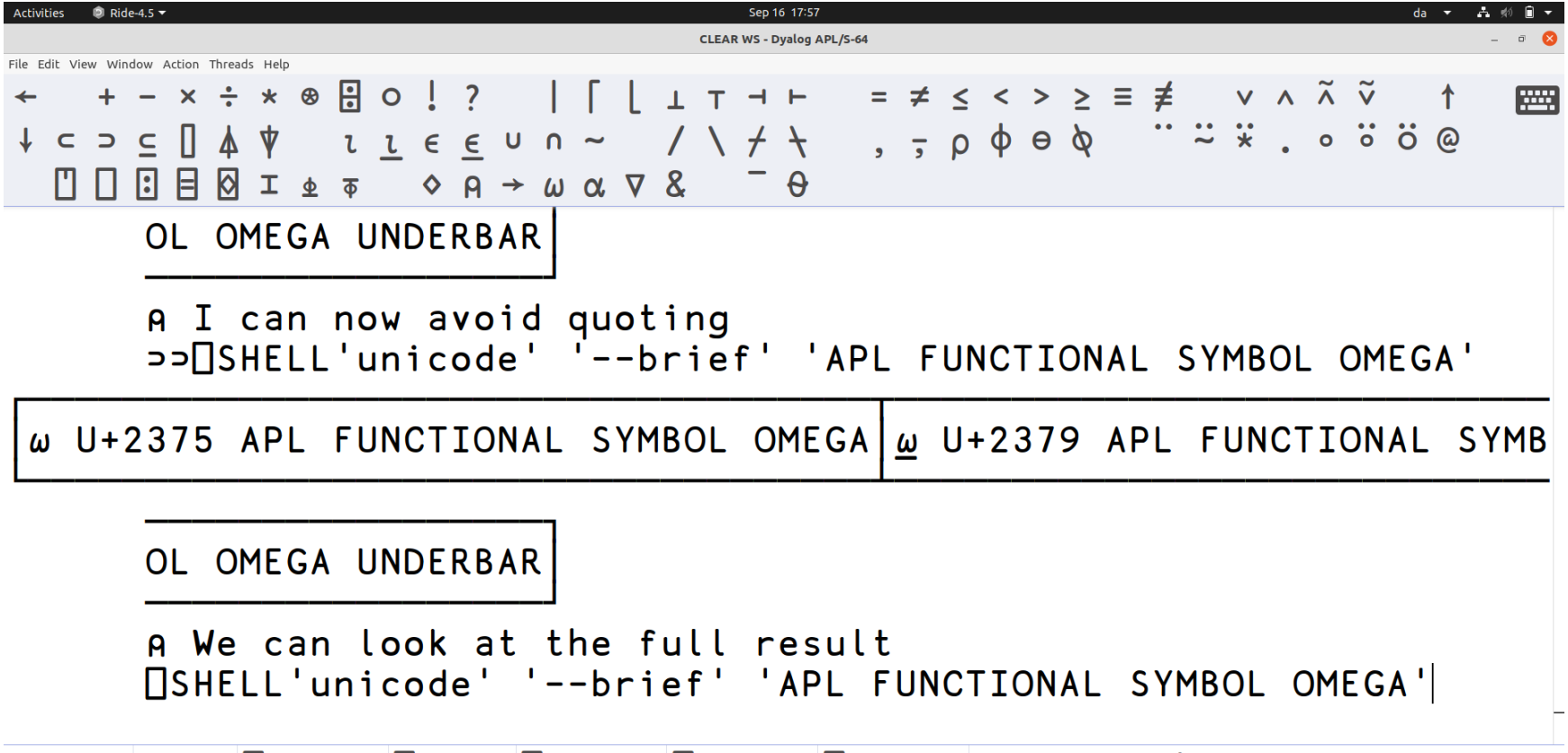

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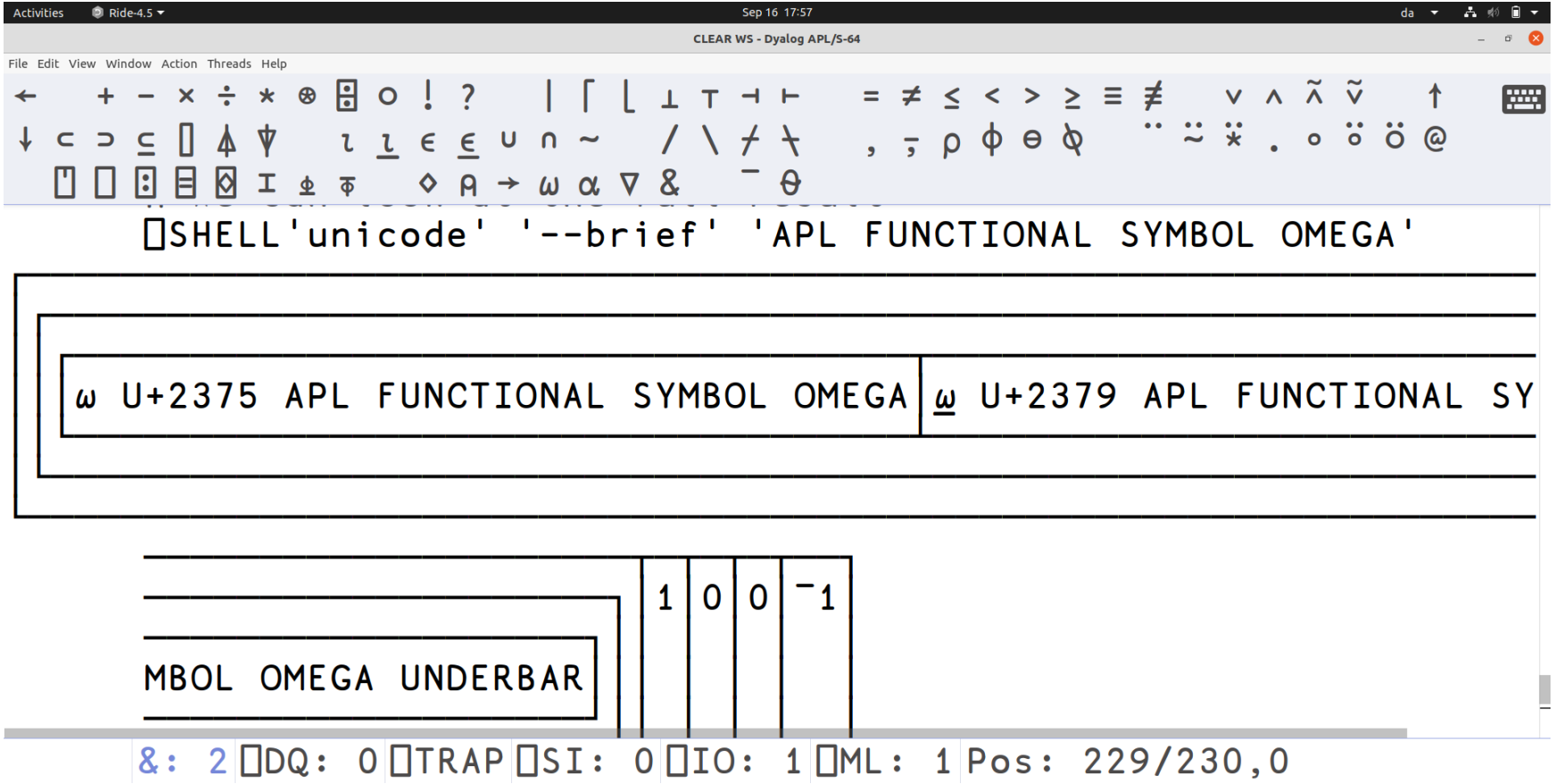

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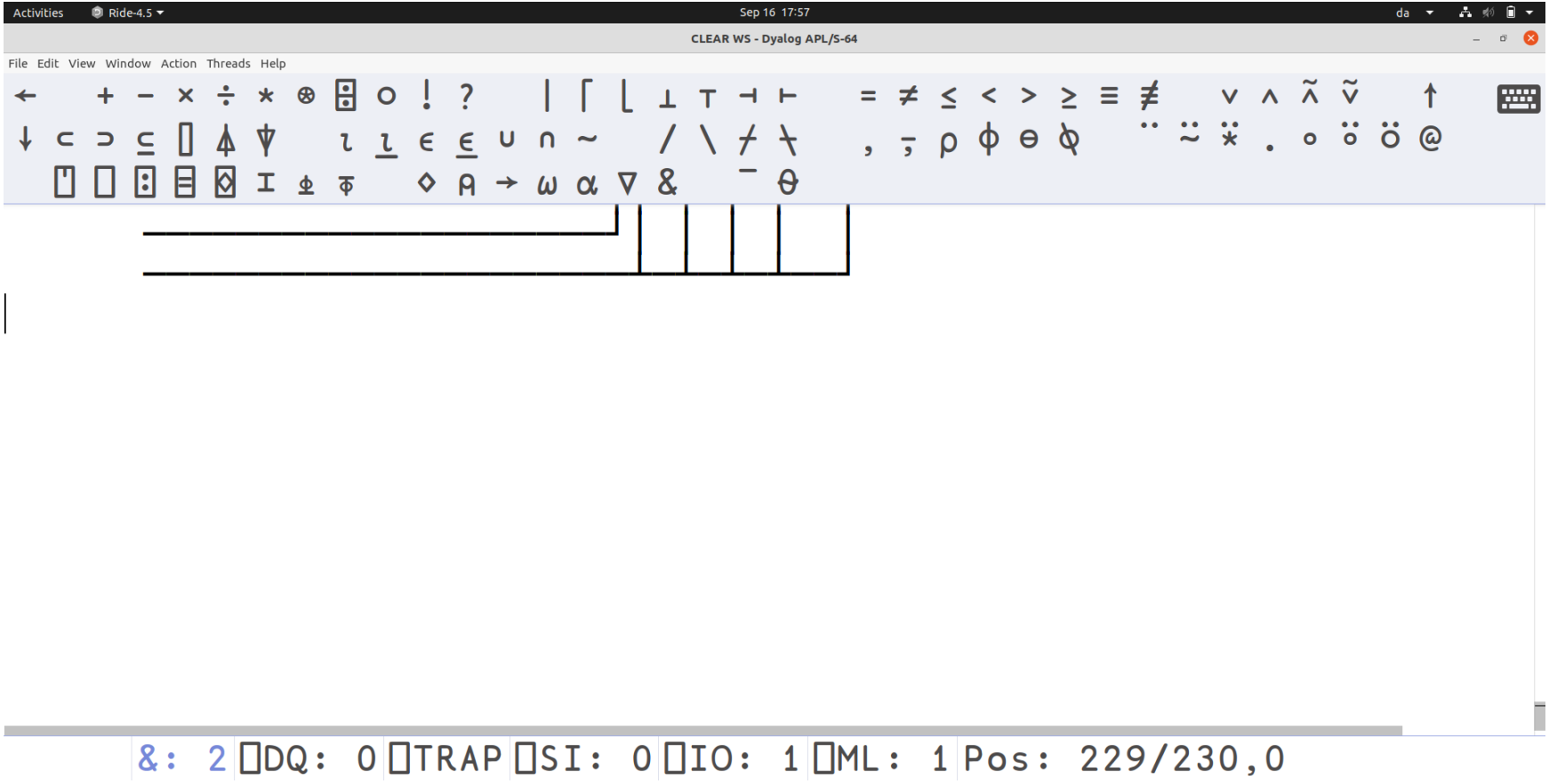

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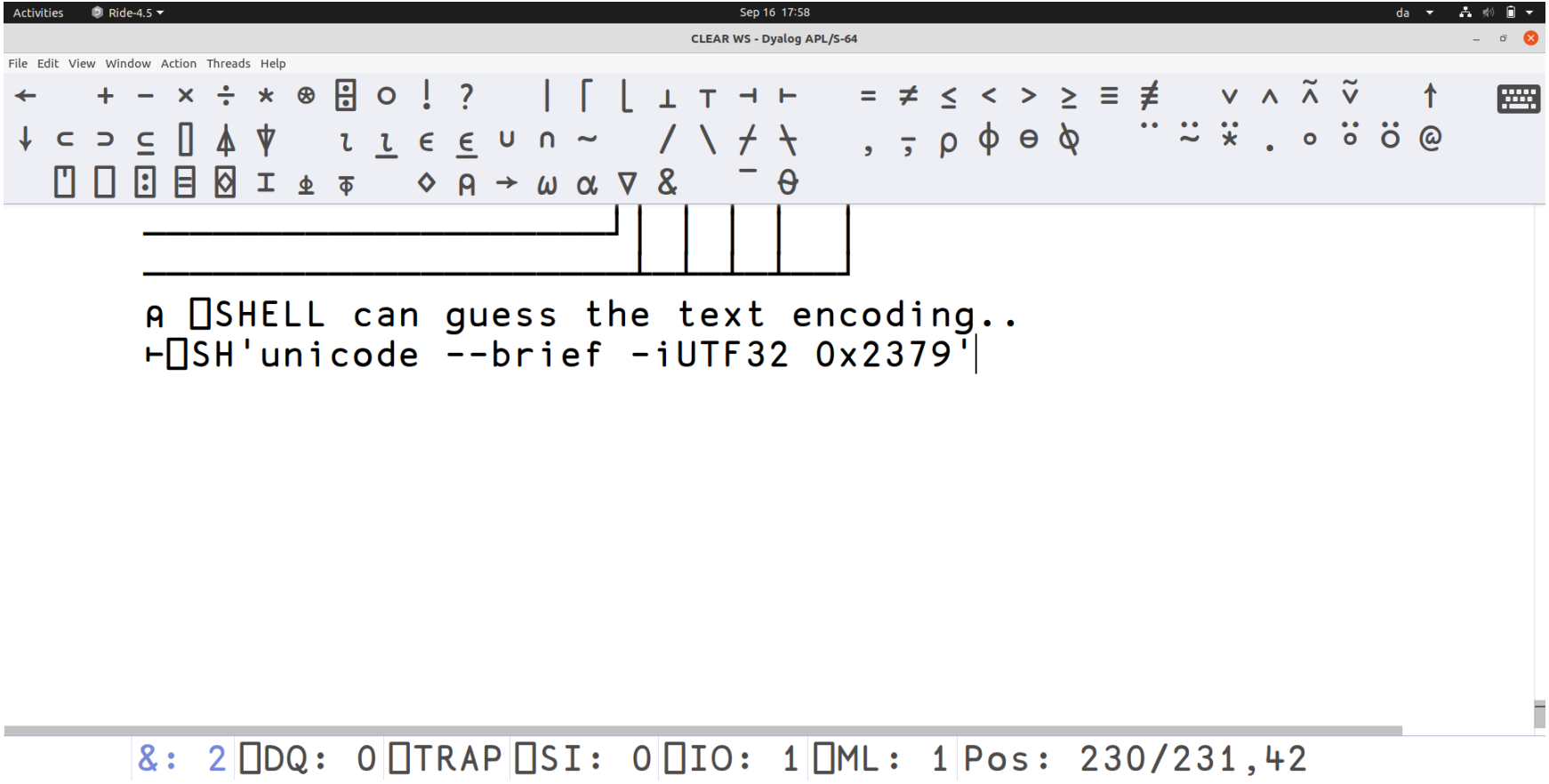

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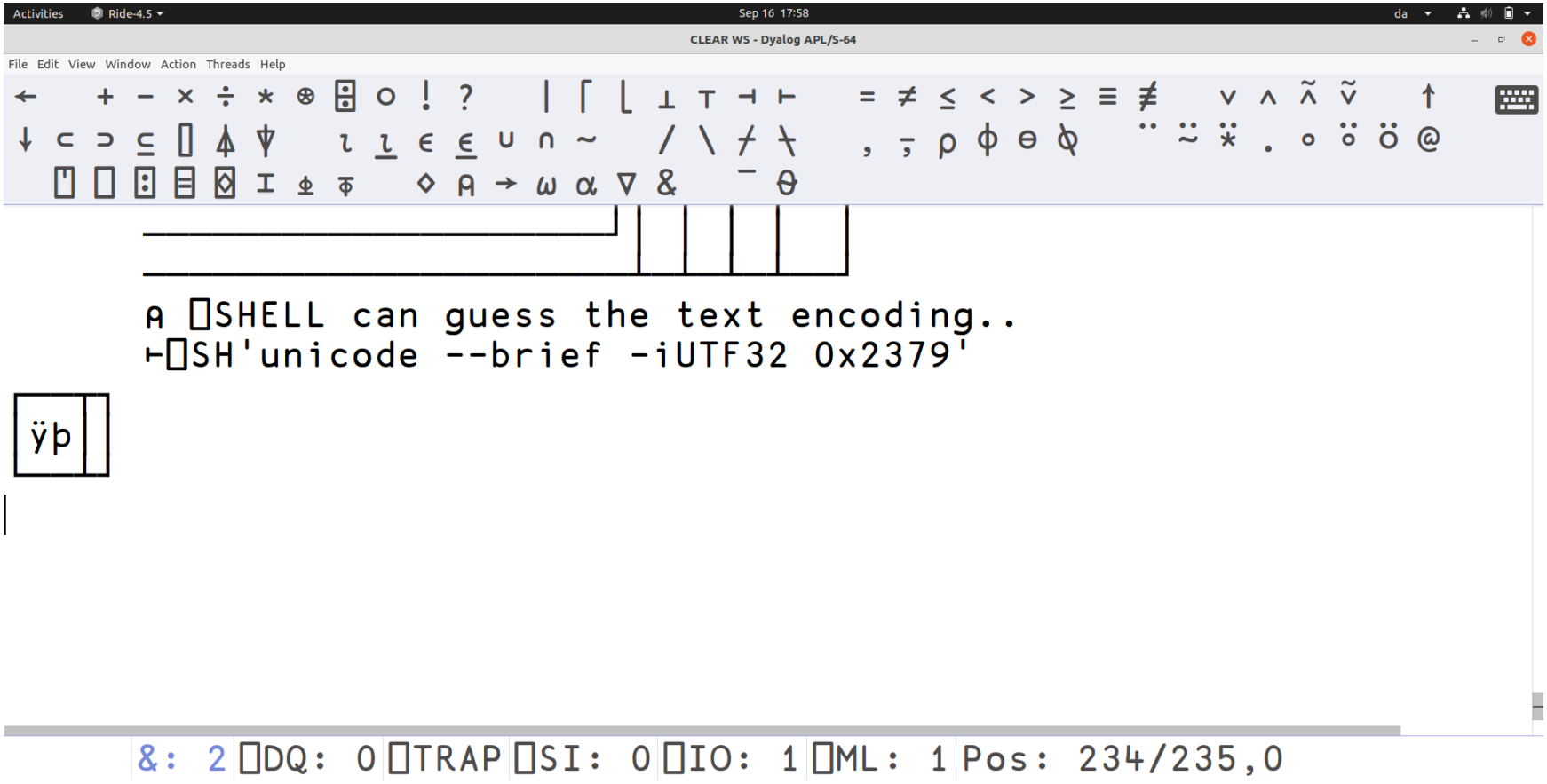

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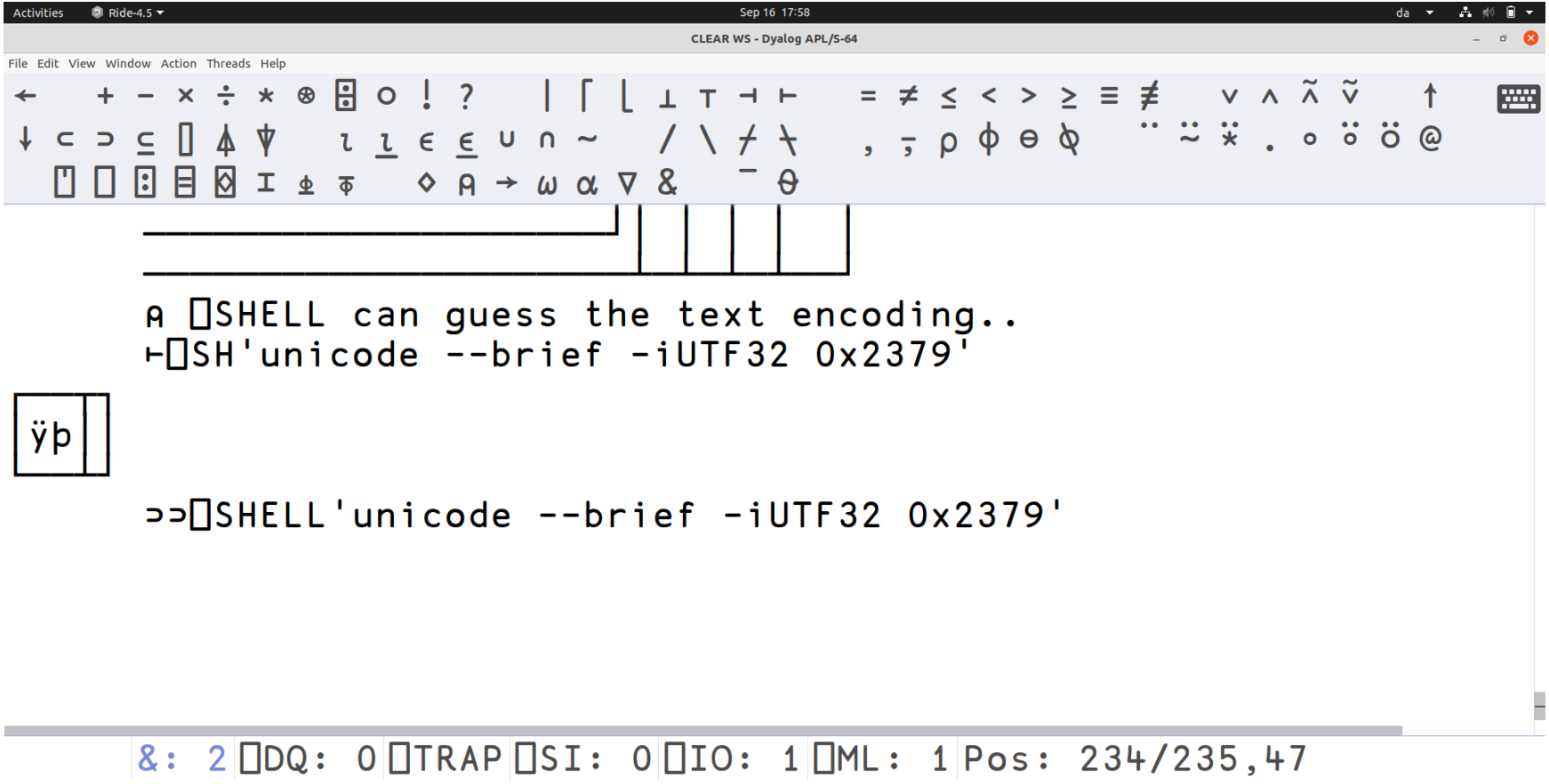

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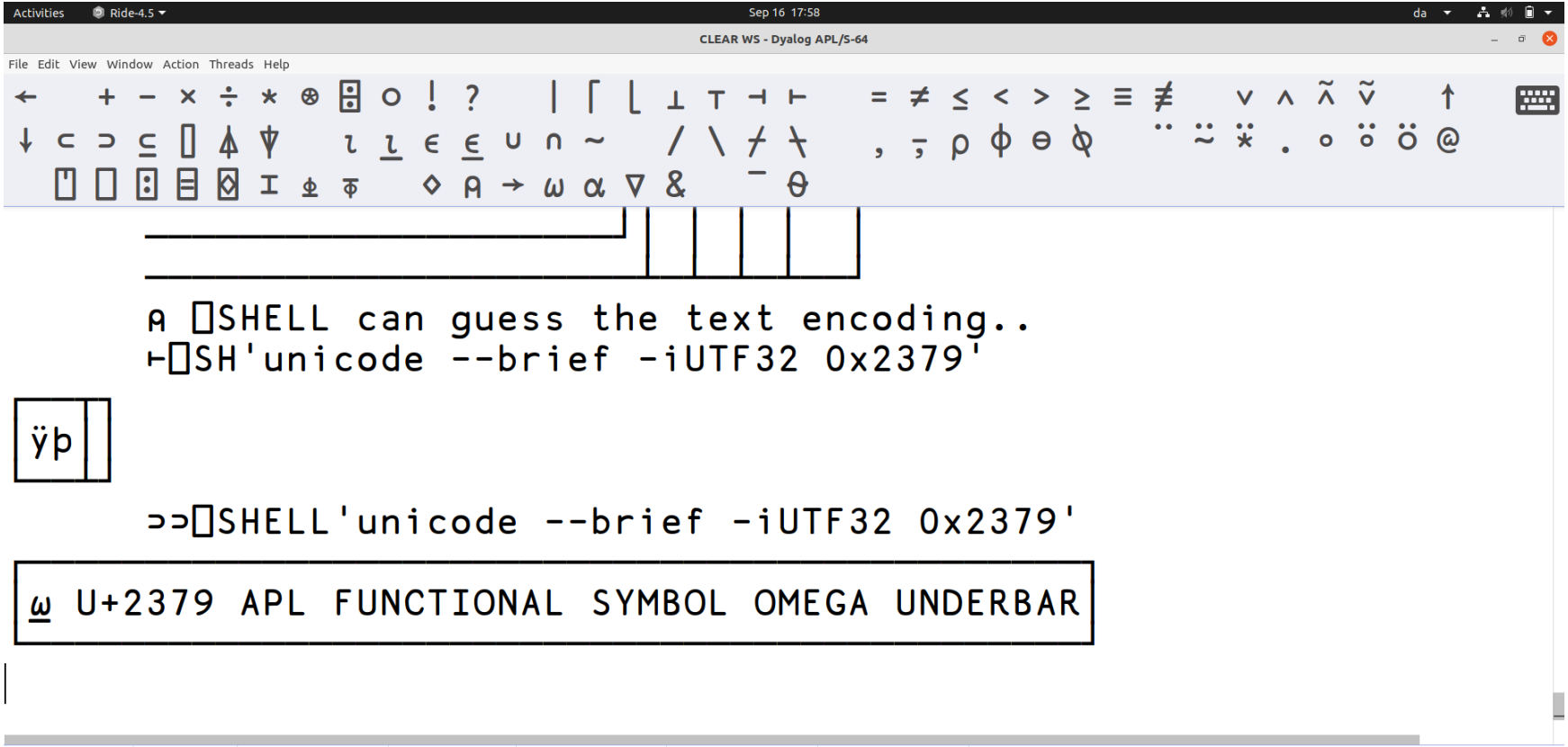

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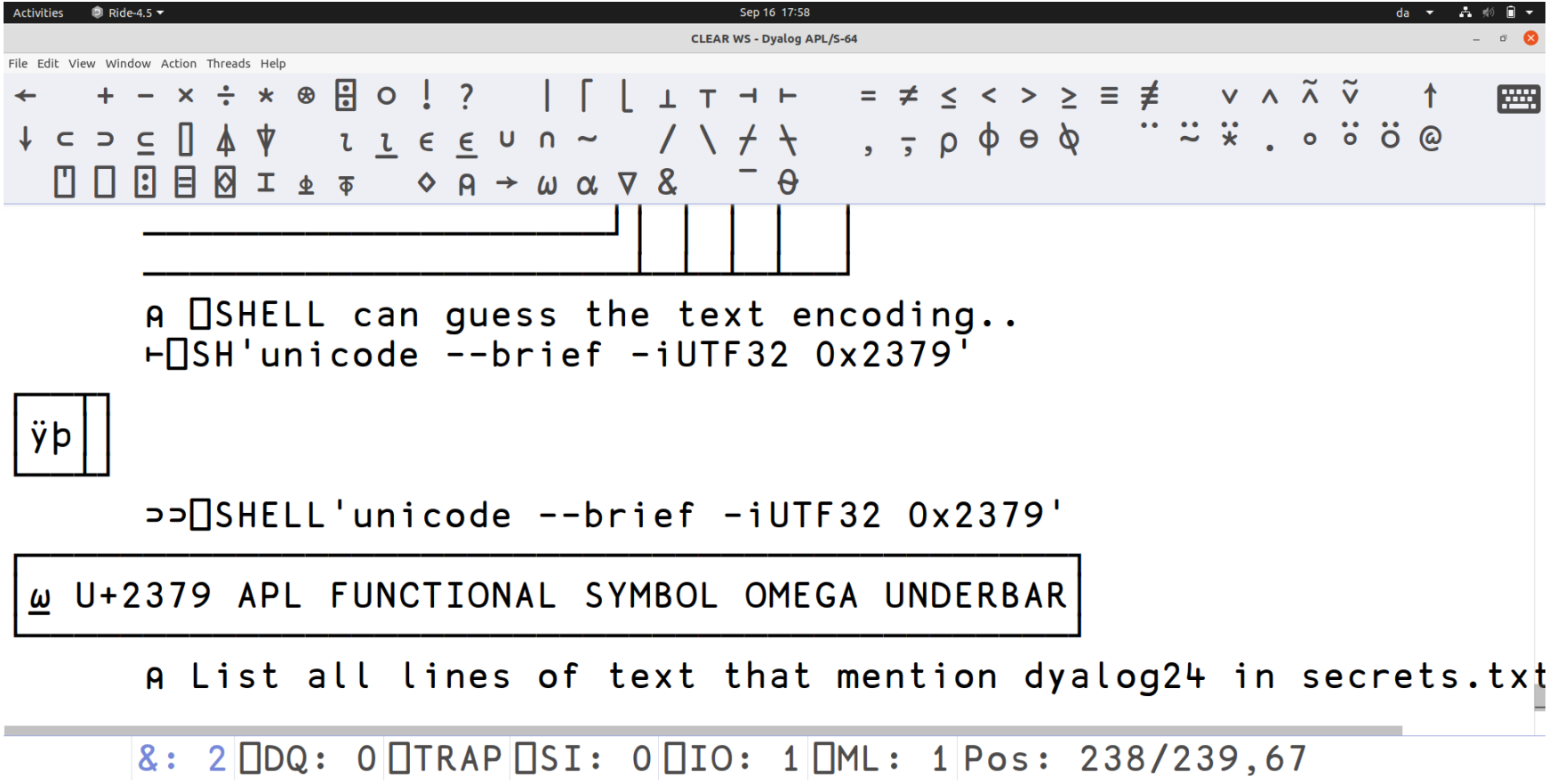

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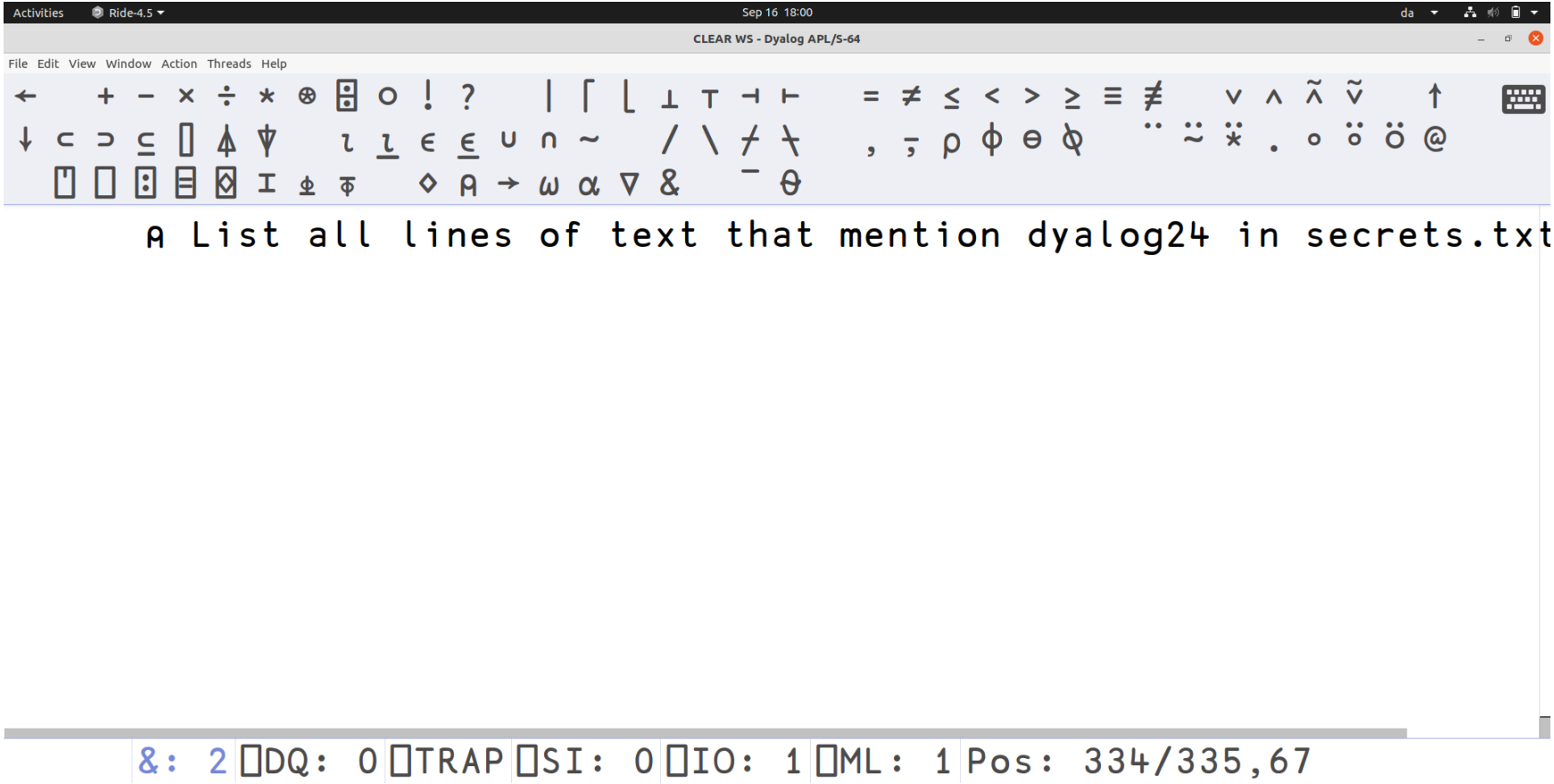

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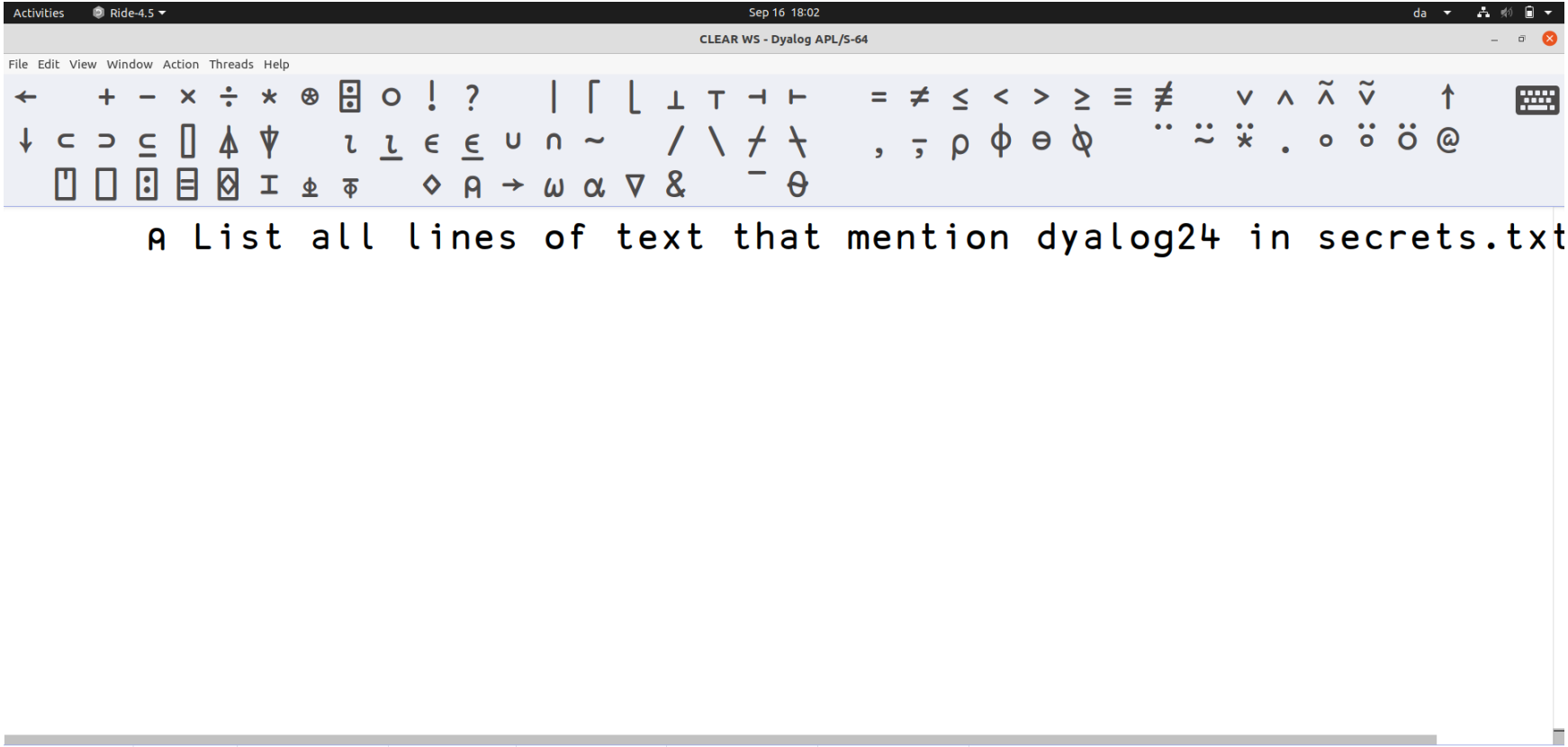

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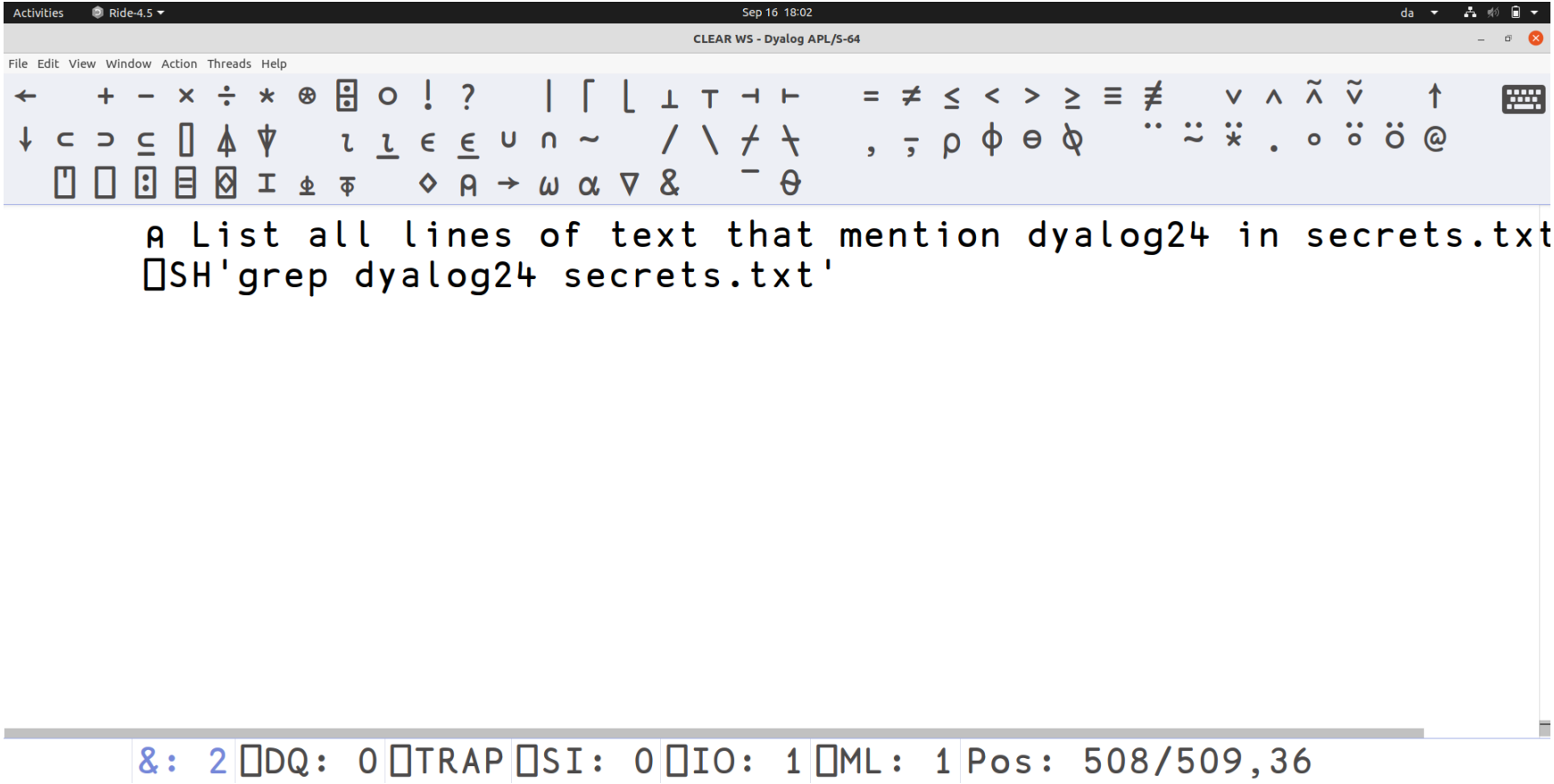

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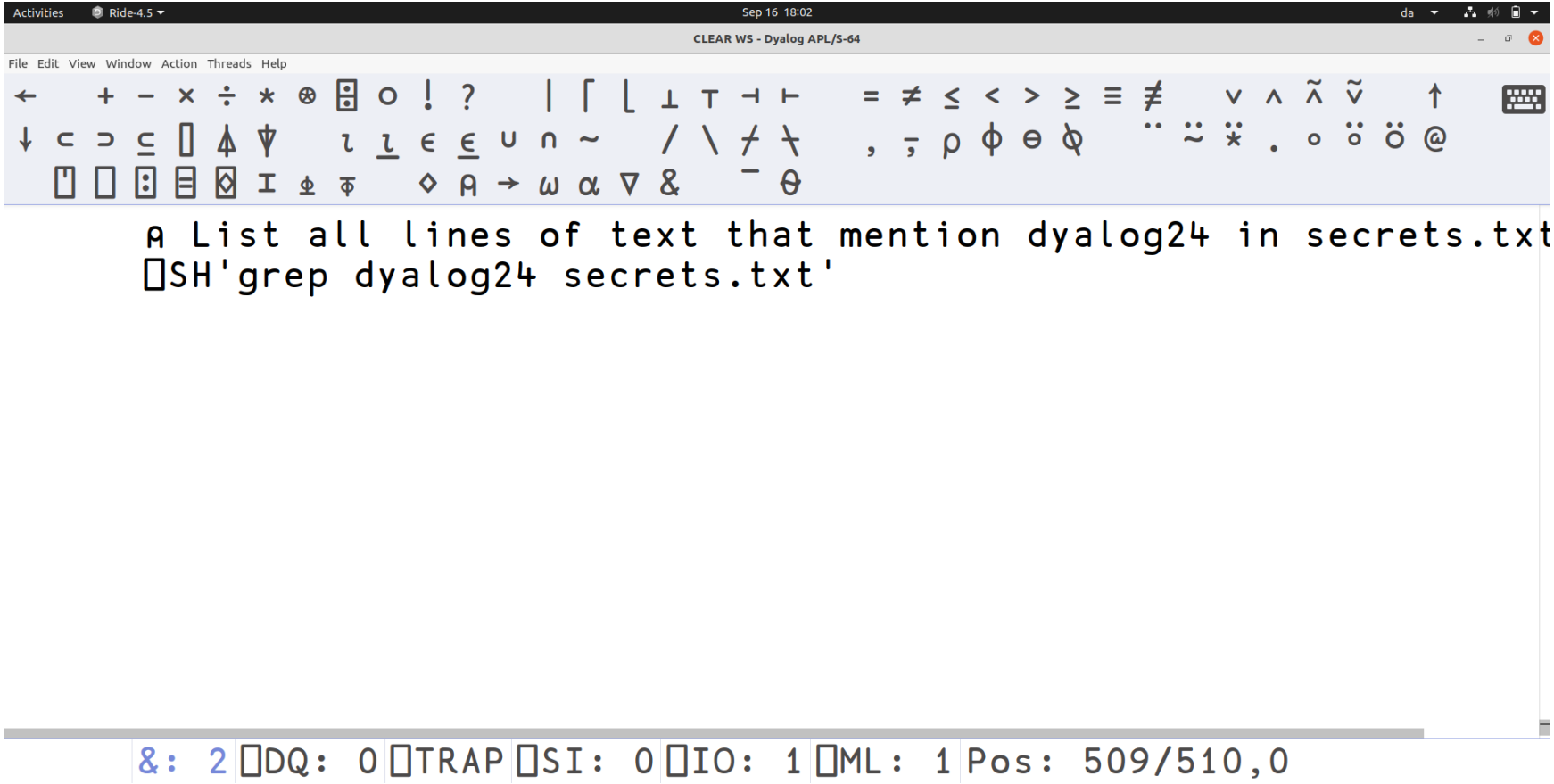

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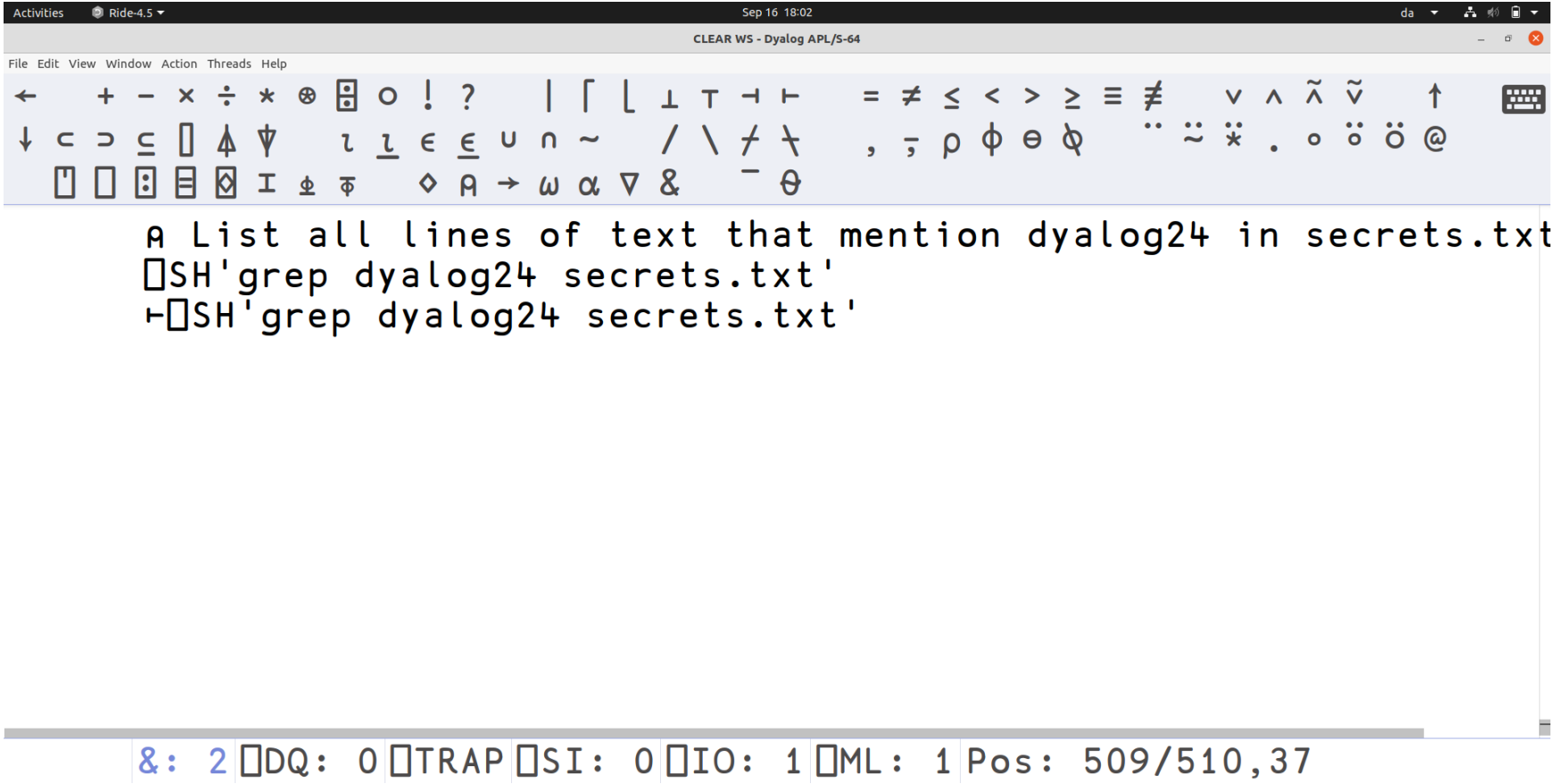

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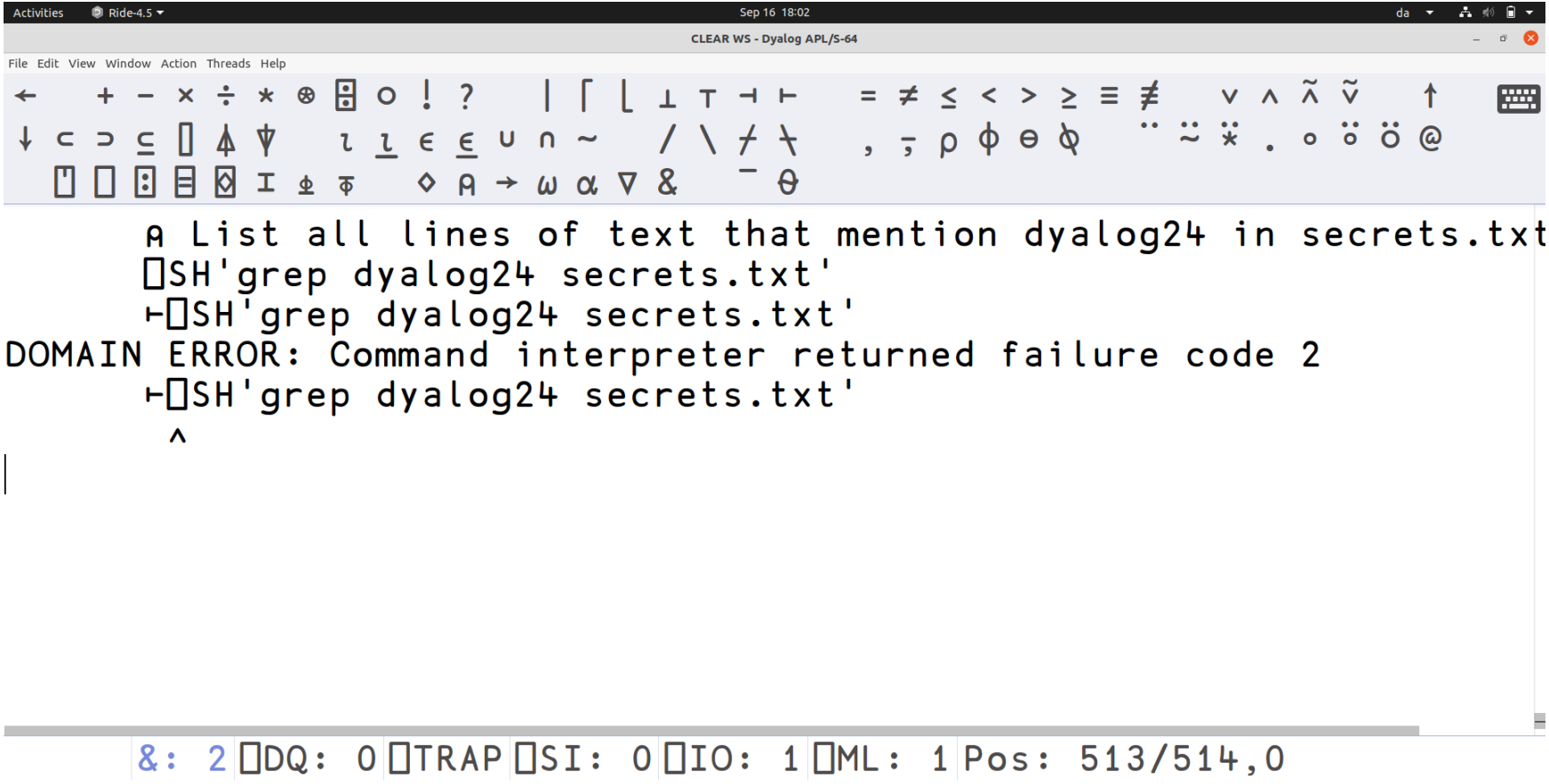

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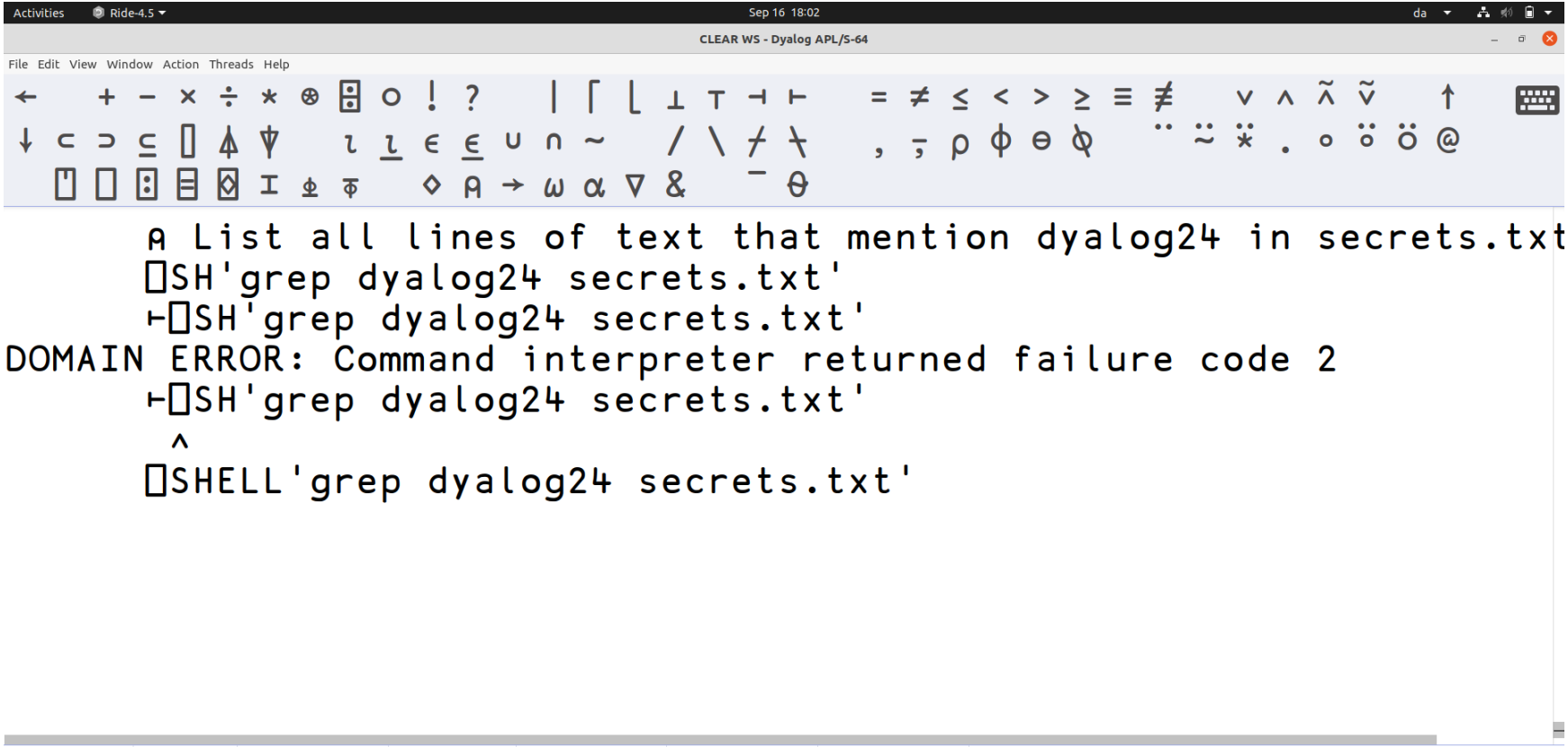

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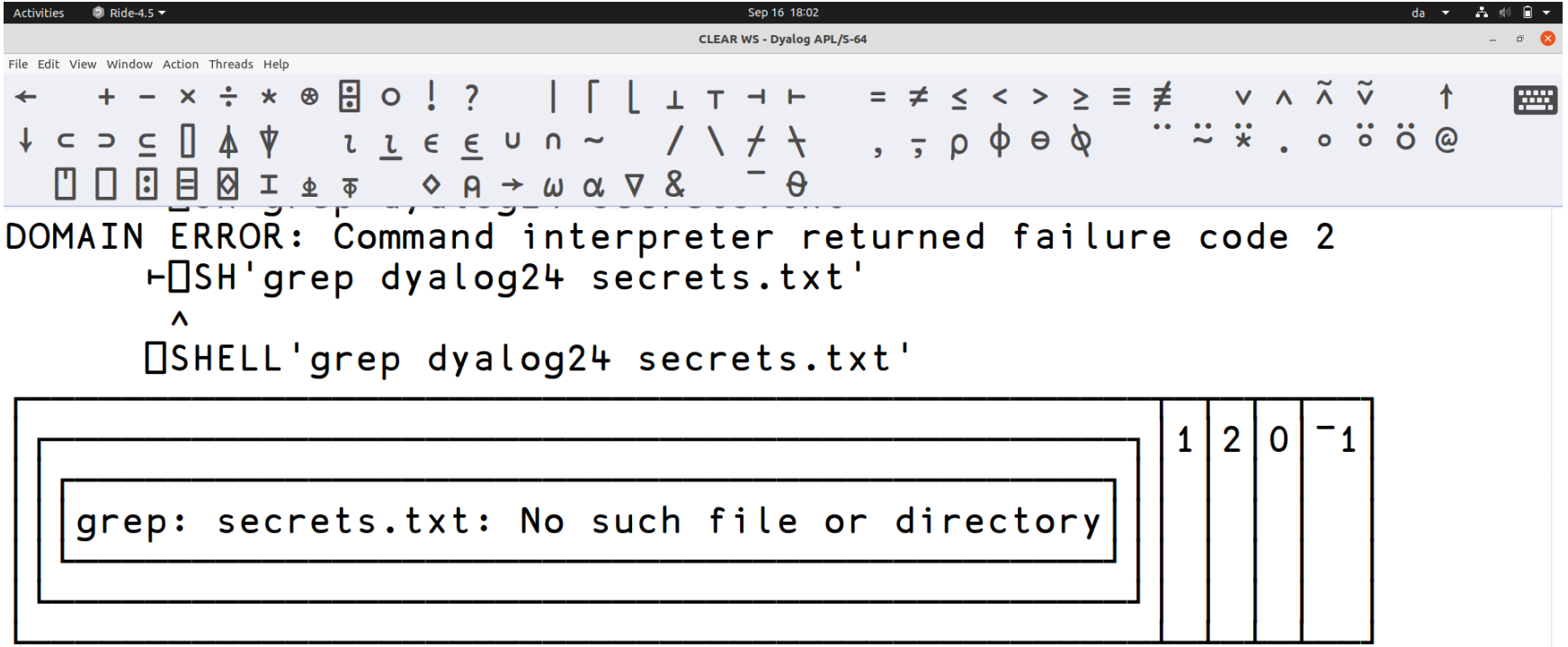

New Function for Shell Calls

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Overview of the variant options

- Many variant options
- Typical usage won’t require much
- Let me know if you disagree with the defaults

'WorkingDir' path

- Simply changes the working directory of the child process
- By default, the same as the interpreter

'InheritEnv' bool

- Every process has a set of environment variables
- By default, inherits the set from the interpreter

⍠'Env' namesAndValues

- Allows the user to add/set additional environment variables
  - Overwrites any inherited values
- Examples:
  - Provide configuration options
  - Set an API key
- 2 column matrix or name-value pairs

'Shell' shellSpec

- Makes it possible to use another shell than powershell or /bin/sh
  - Only relevant when right argument is simple
- Examples:
  - `'/bin/bash' '-c'`
  - `'CMD.EXE' '/C'`

⍠'ExitCheck' bool

- ⎕SH checks the exit code and produce domain error if non-zero
- In ⎕SHELL that is optional
  - Makes it possible to deal with non-zero exits and still get the output produced
  - Much easier figure out what went wrong when the error messages aren’t lost

⍠'Timeout' milliseconds

- Some programs finish "quickly"
- Some might hang or take a very long time
- Set a timeout and cause the ⎕SHELL call to return after a while
  - No TIMEOUT error
  - Data collected so far is available

'Signal' number

- SHELL can stop before the child process
- Child process potentially still running
- Requires cleanup
- Automatically send a signal to the child process
  - SIGTERM by default
  - On windows we don't have signals, but 9 (SIGKILL) calls TerminateProcess
  - Often the child process dies on own

'Window' mode

- CMD on windows supports specifying initial window mode
  - Hidden, Maximised ...
  - Done via a nested right argument
- Exactly the same thing
  - Variant option because right argument means something else

'Output' redirections

- Which output streams to collect, and what to do with the data
- Default is to collect stdout as text, and redirect stderr to stdout
- 2-column matrix or vector of streamId-target pairs
- Quite a few possible targets

'Output' redirections

- ('Stream' StreamNum) or just StreamNum
- ('File' TieNum) or just TieNum
- ('File' FilePath)
- ('Array' DataType)
- ('Array' TextEncoding) or just 'Array'
- 'Null'

⍞'Output' redirections

- `('Callback' Fn EncodingOrType)`
- `('Callback' Fn)`
  - Whenever data is produced, run a callback function to deal with it
- `Fn` is name of function, or `(FnName LeftArg)`
- Callback passed a namespace with information
- Data does not show up in the `⎕SHELL` result value

'Input' redirections

- Controls what the child process sees when it tries to read from its input streams
- By default, only stdin is setup, such that the child process gets no data
- 2-column matrix or vector of streamId-source pairs

'Input' redirections

- ('File' TieNum) or just TieNum
- ('File' FilePath)
- ('Array' Data Type)
- ('Array' TextData Encoding)
- ('Array' TextData Encoding Newline)
- 'Null'

⍞'Input' redirections

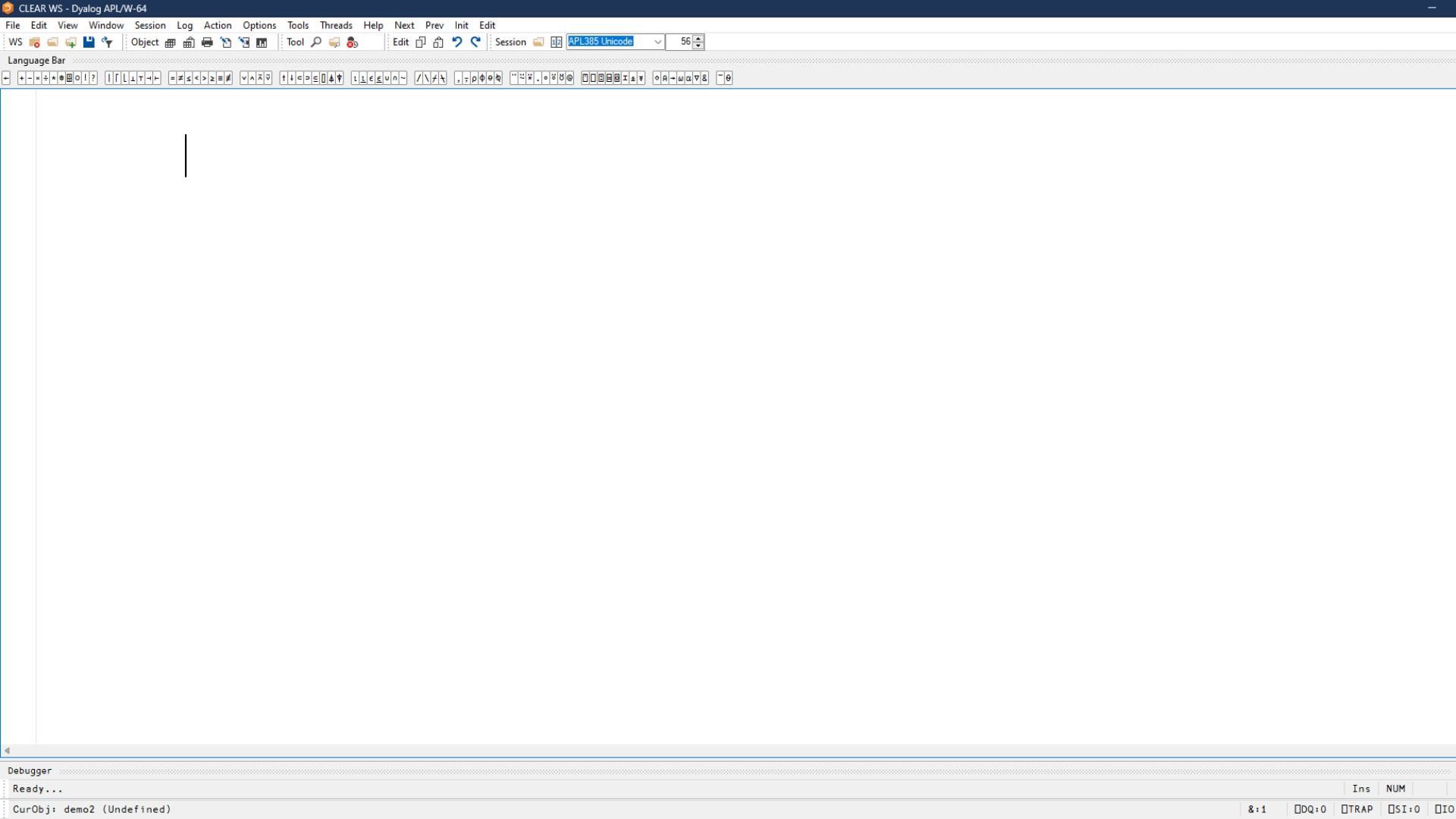
- `('Token' tokenNumber)`
- All the other sources required all data to be specified before running ⎕SHELL
- Send additional data:
  - `('Array' …) ⎕TPUT tokenNumber`
- Tell ⎕SHELL that no more data will appear:
  - `⎕TPUT tokenNumber`

Default redirections

- ⎕SHELL always sets up redirections for the three standard streams if not explicitly setup
- Input:
  - `0 'Null'`
- Output:
  - `2 ('Stream' 1)`
  - `1 'Array'`

Demo

- How to use `SHELL` to run `python3`
- Some variant options will be used


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session
APL385 Unicode
56
Language Bar
Debugger
Ready...
Ins
NUM
CurObj: demo2 (Undefined)
&:1
⎕DQ:0
⎕TRAP
⎕SI:0
⎕IO

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
      ]box on
```

Debugger

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Was OFF
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WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
      ]box on
Was OFF
      ⍝ We are going to run python3
```

Debugger

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CurObj: python3 (Undefined) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

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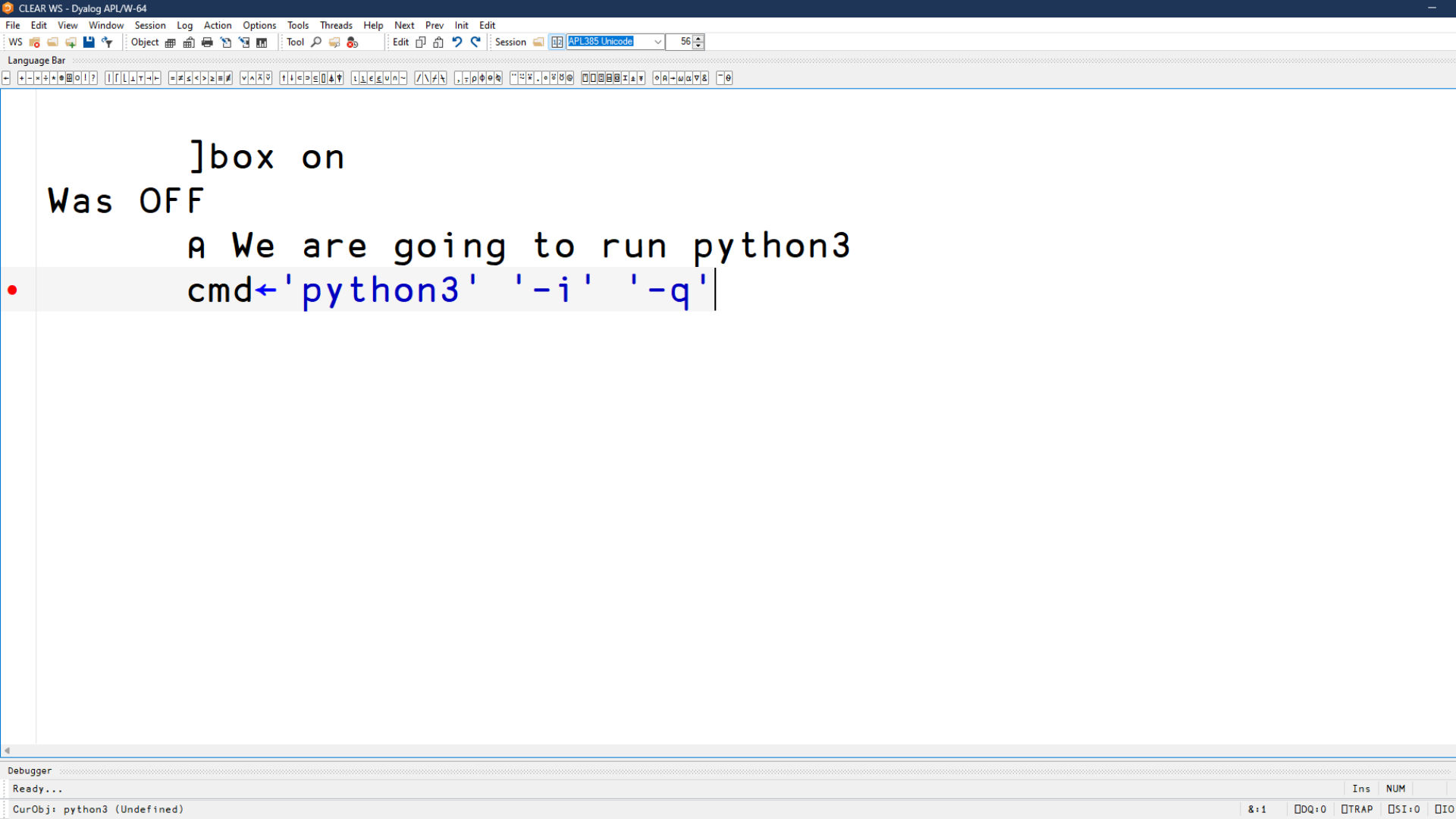
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Debugger
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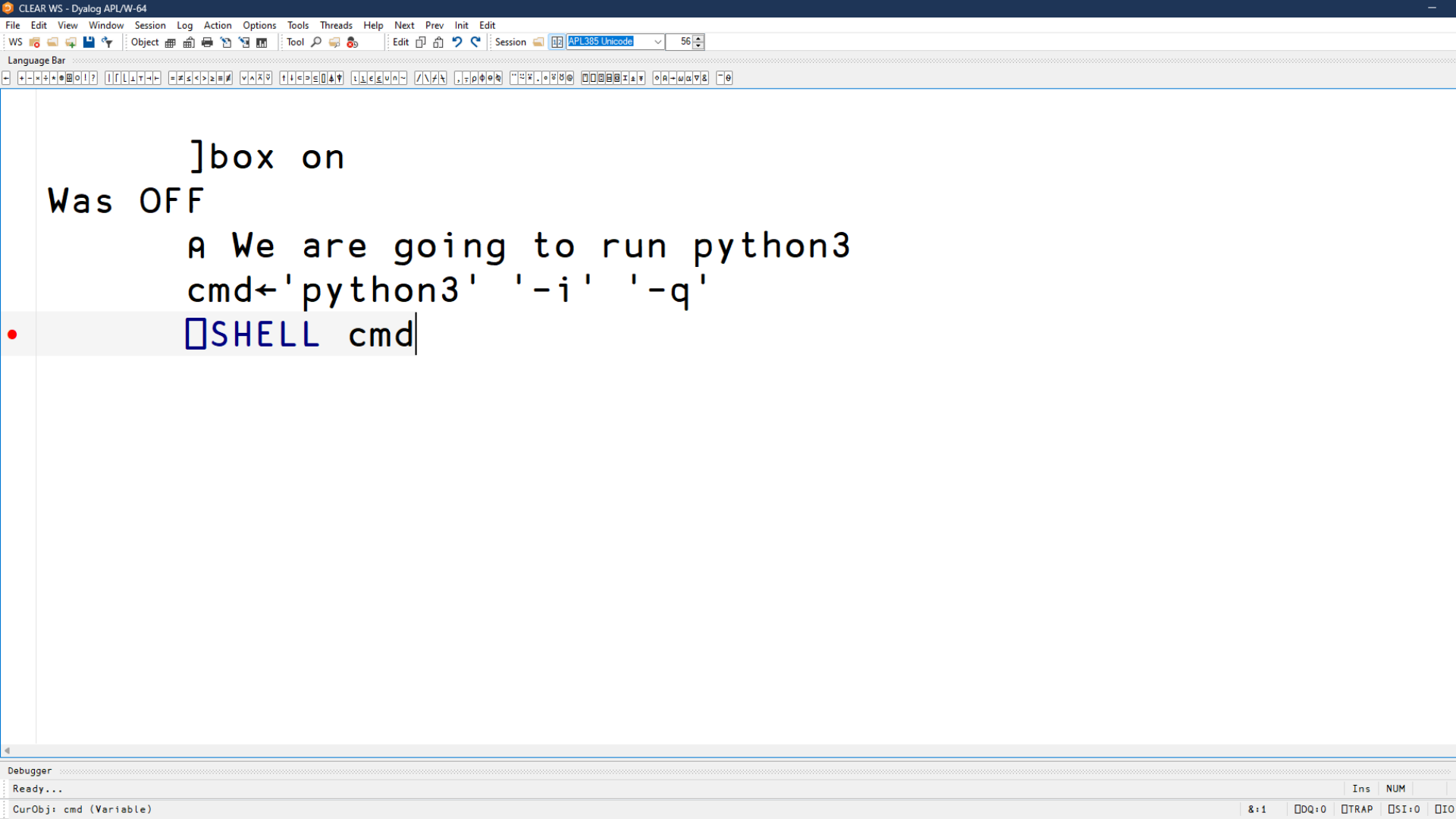
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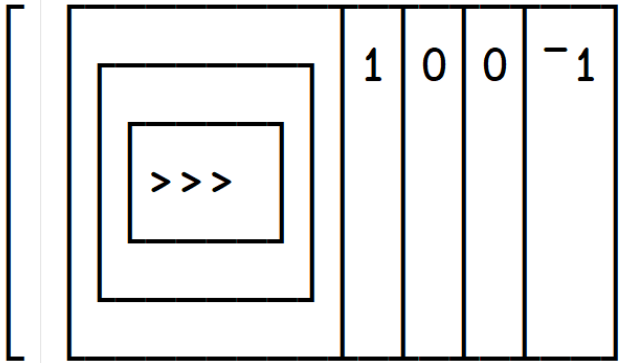
      ⎕SHELL cmd
```

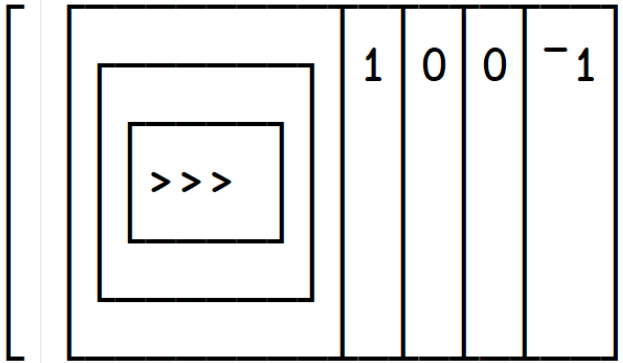


Debugger

Ready... Ins NUM

CurObj: cmd (Variable) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

```
      ]box on
Was OFF
      ⍝ We are going to run python3
      cmd←'python3' '-i' '-q'
      ⎕SHELL cmd
```




```
      ⍝ We can give it some input to process
```

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

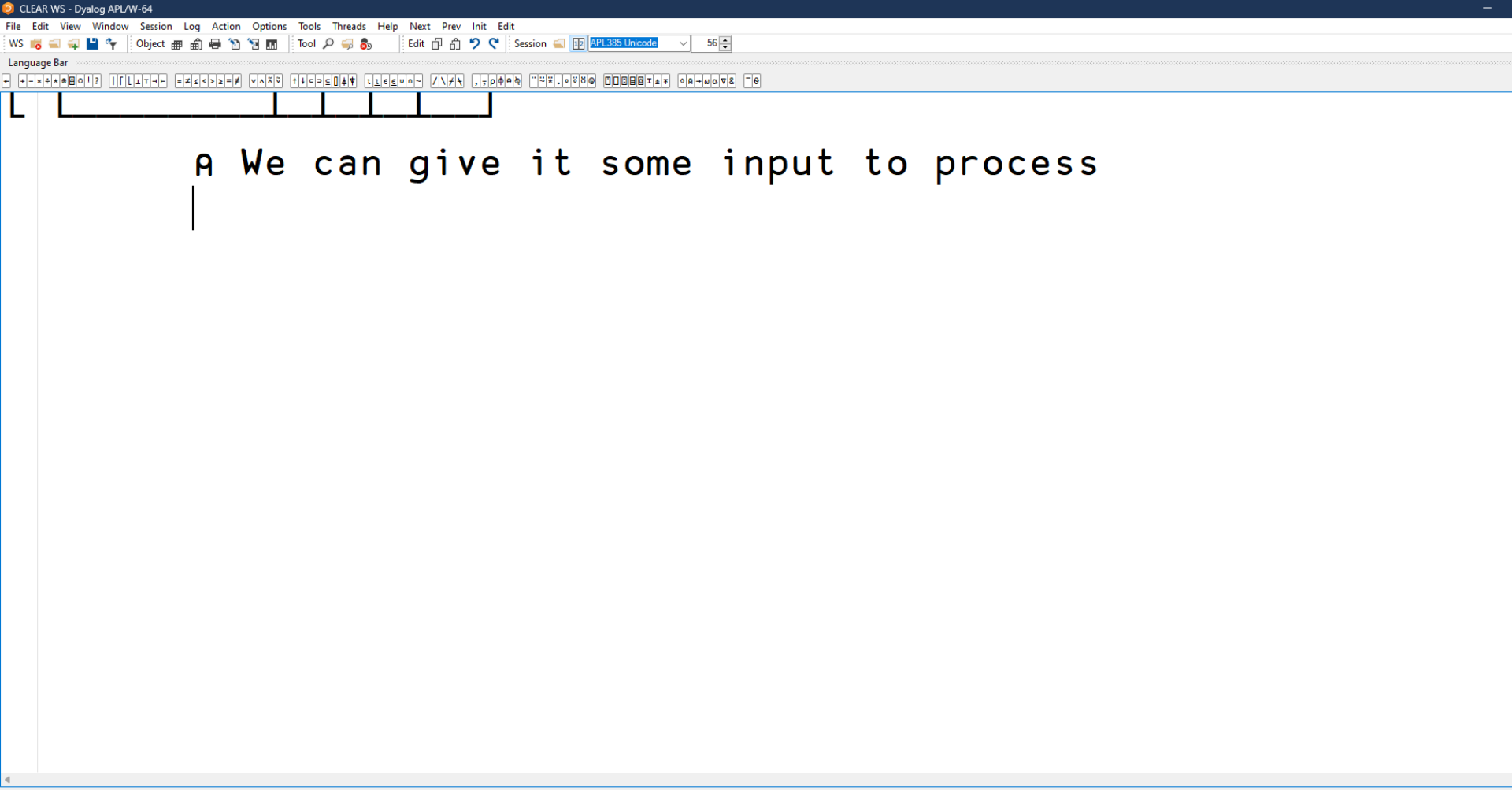
Language Bar

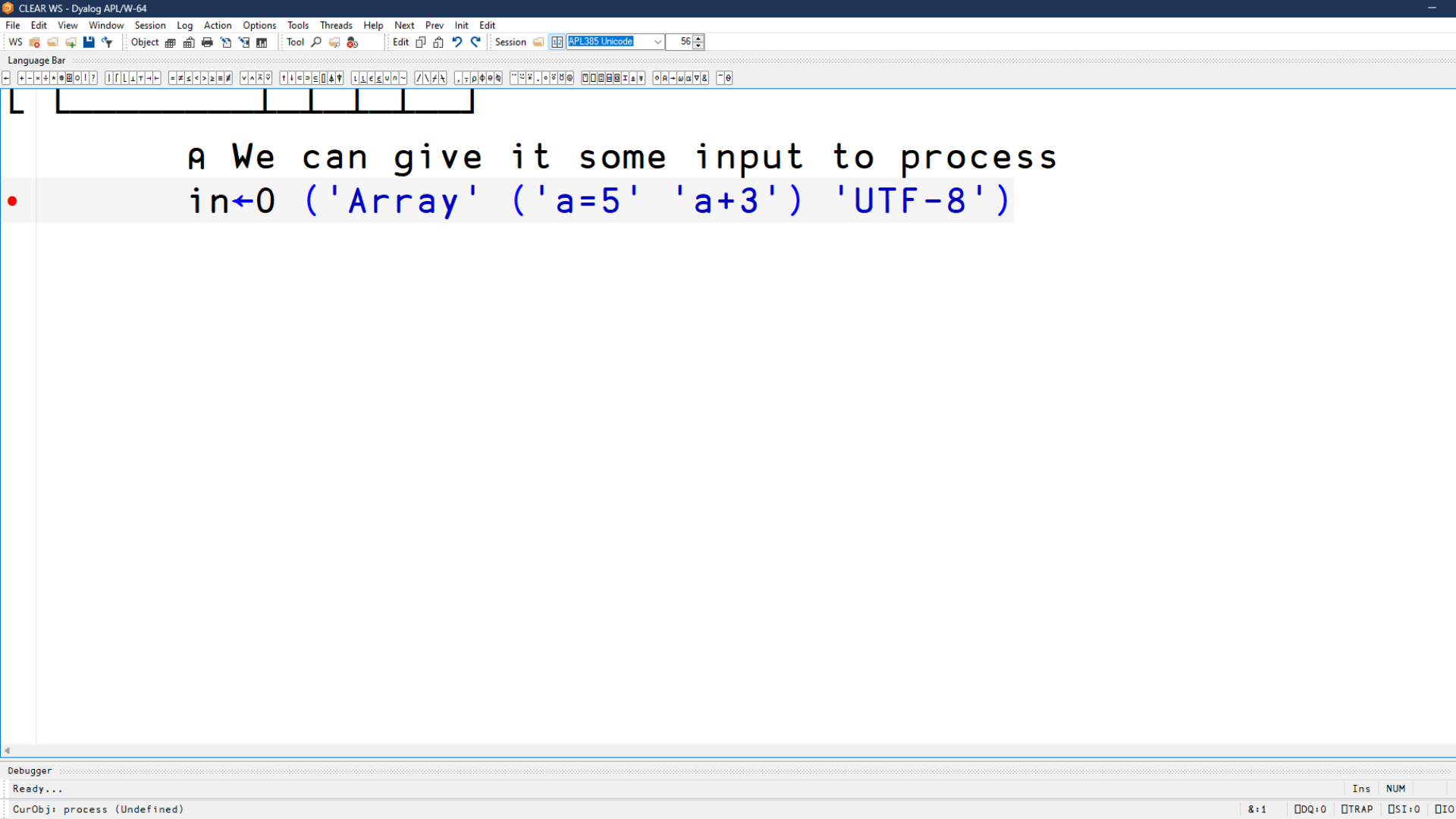
```
      ⍝ We can give it some input to process
```

Debugger

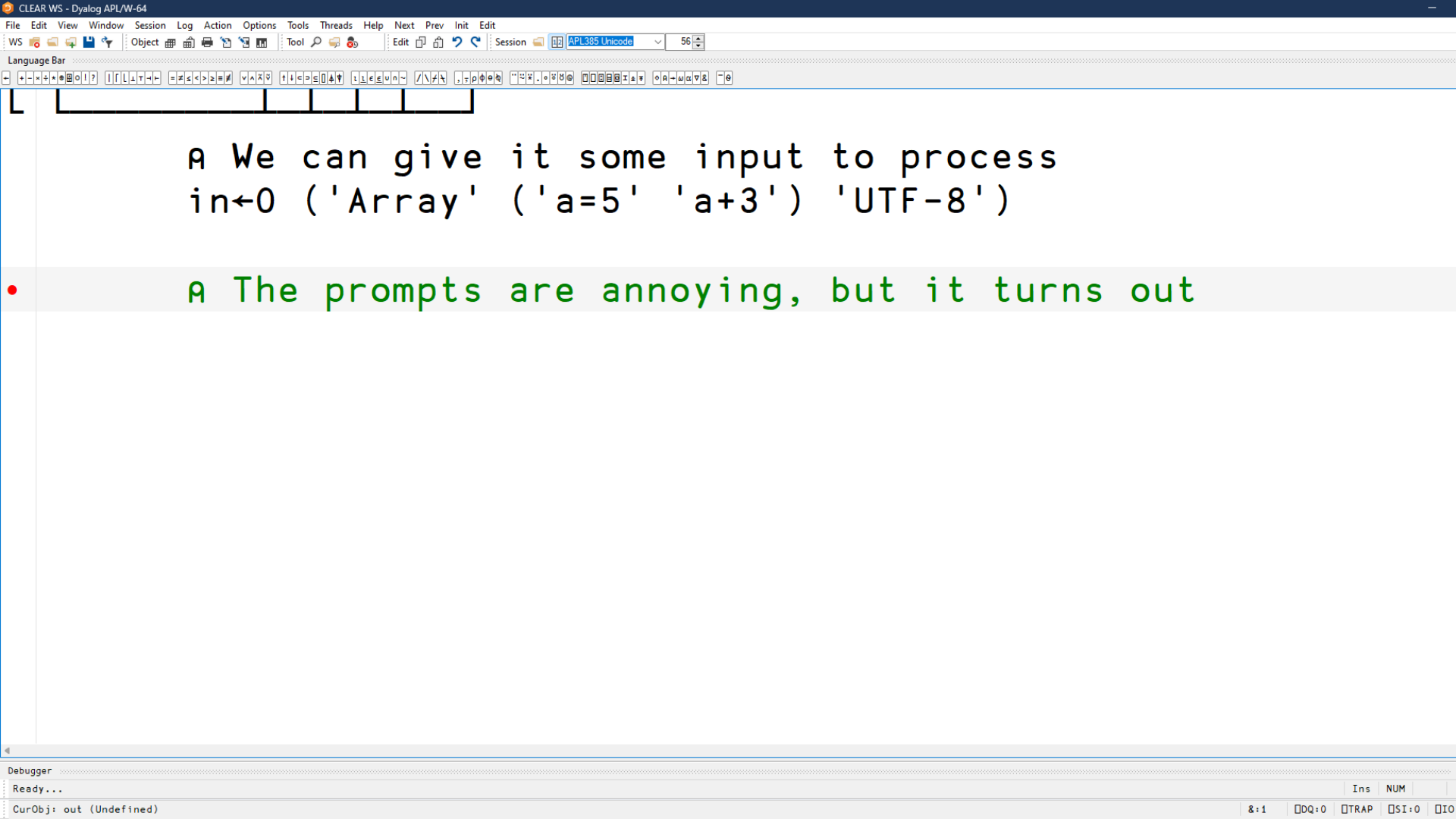
Ready... Ins NUM

CurObj: process (Undefined) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
Debugger
Ready... Ins NUM
CurObj: process (Undefined) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
Debugger
Ready...
Ins NUM
CurObj: process (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←⍬ ('Array' ('a=5' 'a+3') 'UTF-8')
Debugger
Ready...
Ins NUM
CurObj: cm (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
⍝ The prompts are annoying, but it turns out
Debugger
Ready...
Ins NUM
CurObj: out (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
      ⍝ We can give it some input to process
      in←⎕NQ '' 'Array' ('a=5' 'a+3') 'UTF-8')

      ⍝ The prompts are annoying, but it turns out
```

Debugger

Ready... Ins NUM

CurObj: out (Undefined) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

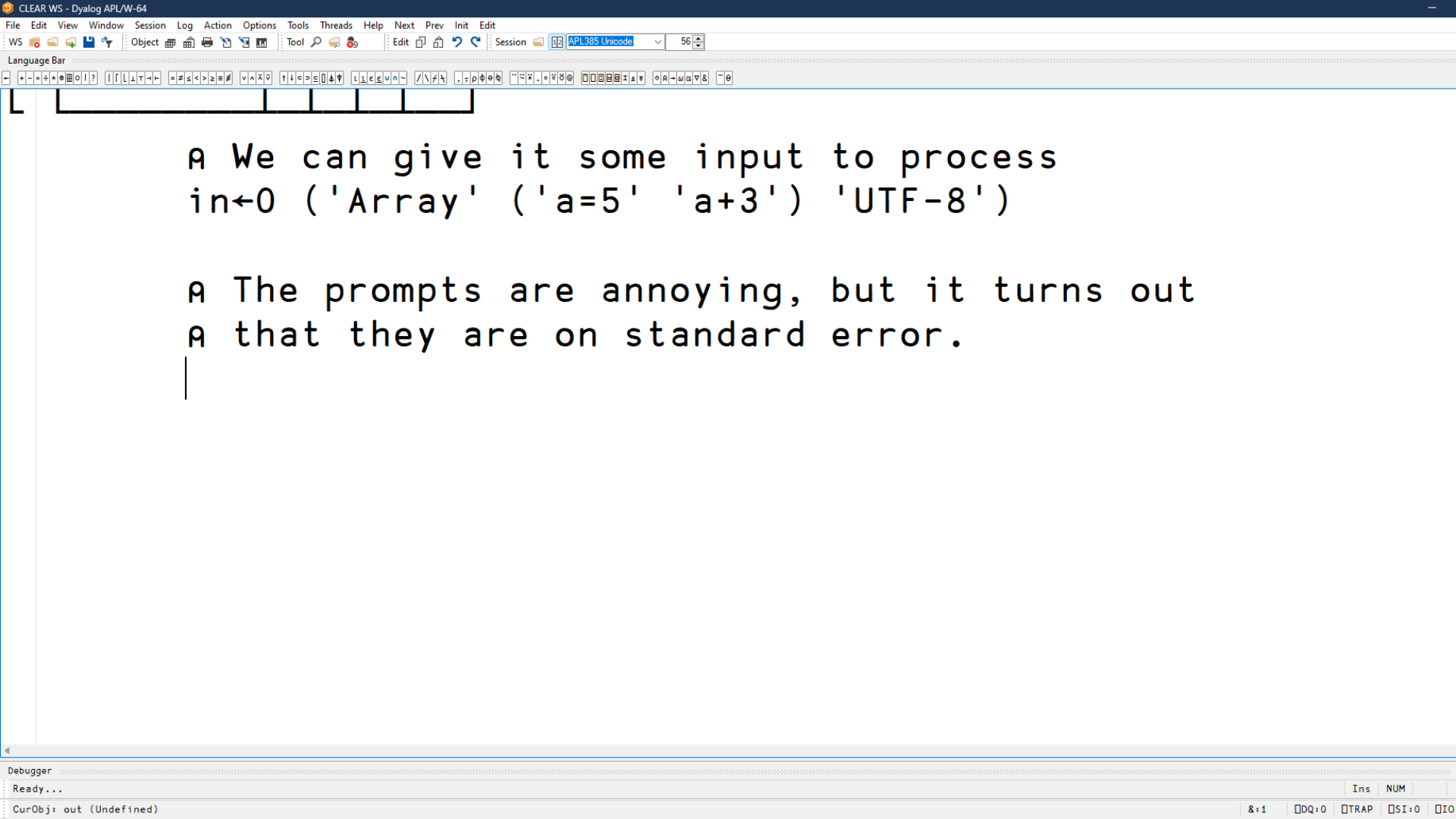
```
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')

⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
```

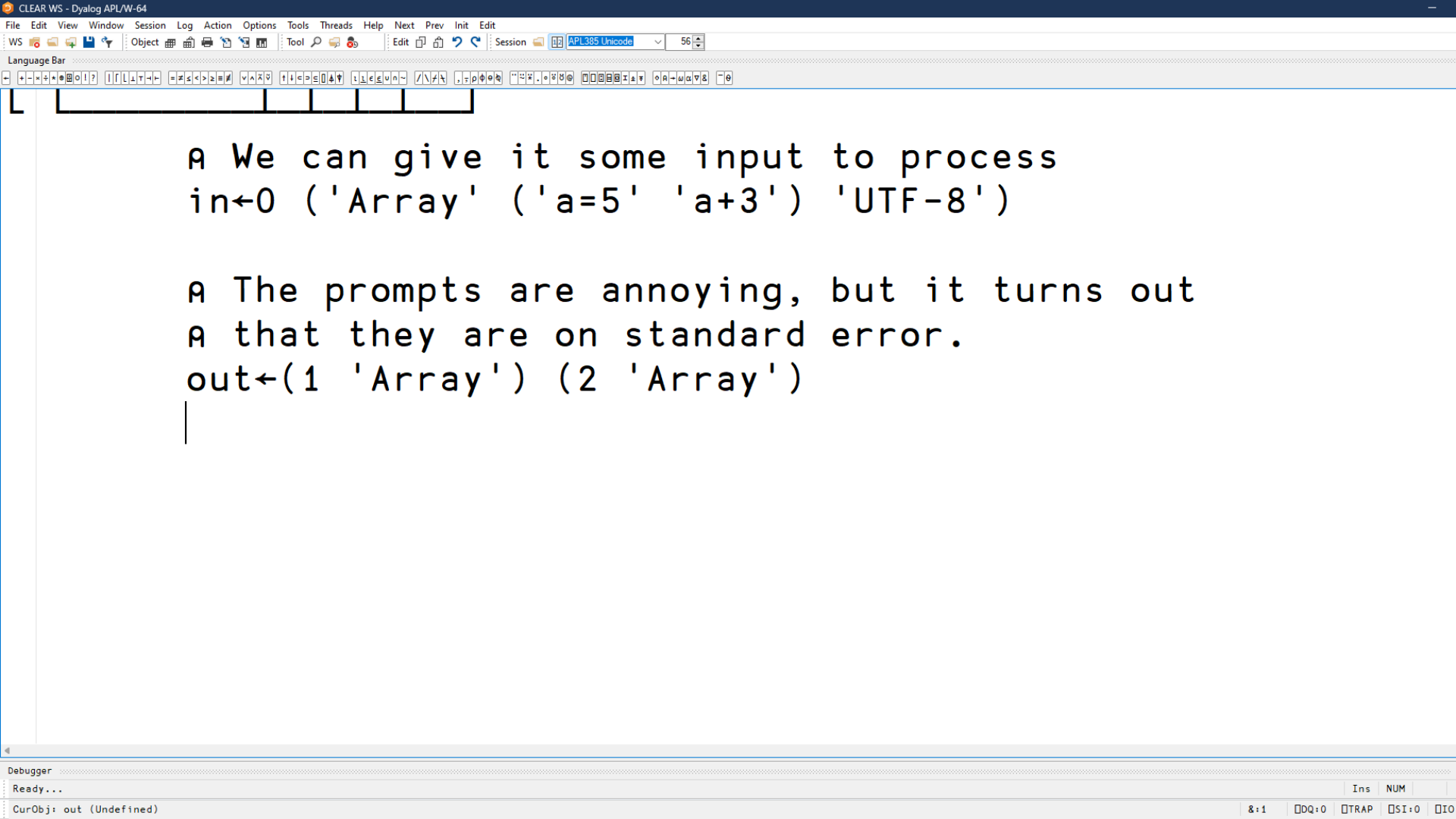
Debugger

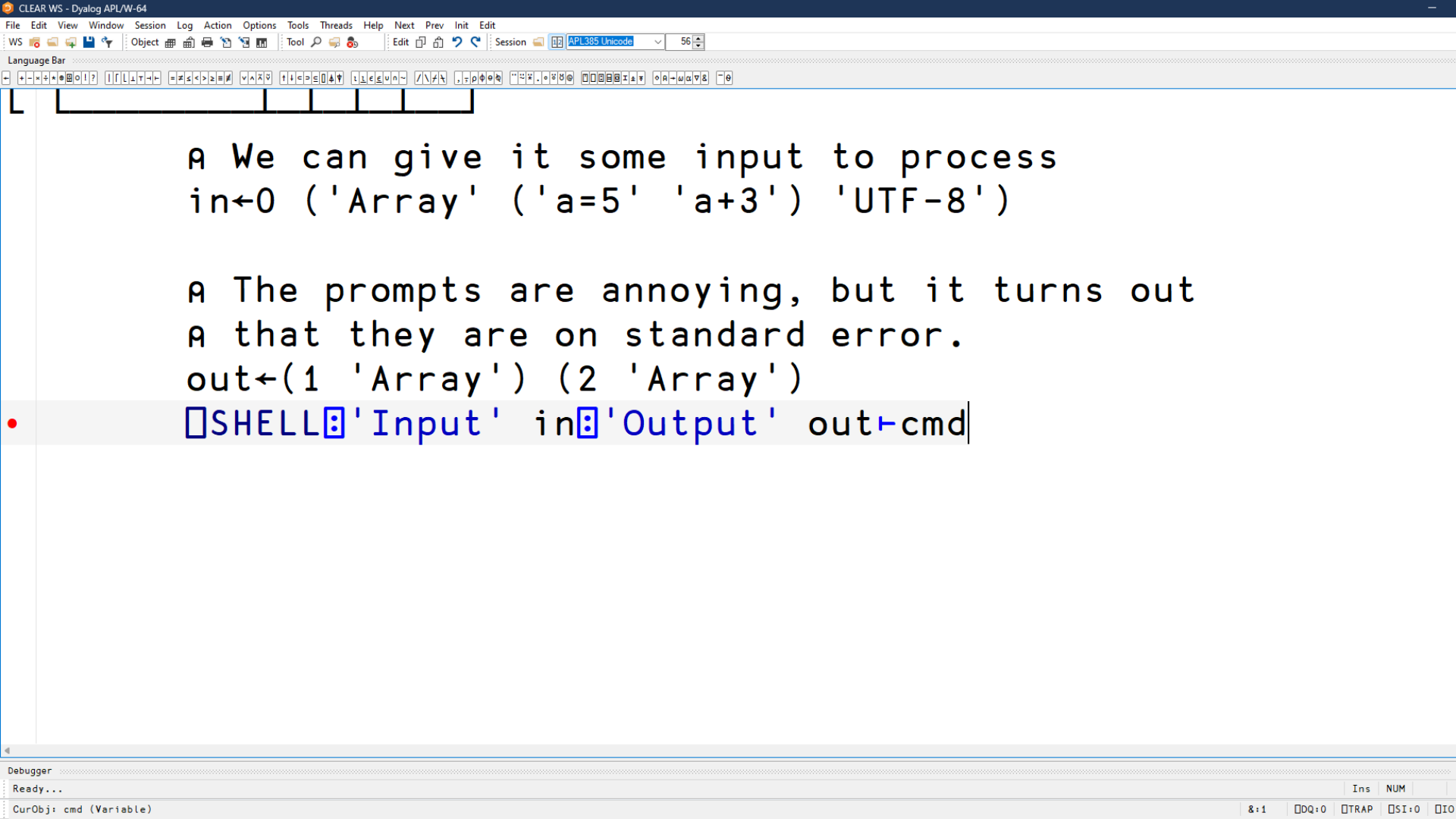
Ready... Ins NUM

CurObj: out (Undefined) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
Debugger
Ready...
Ins NUM
CurObj: out (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
out←(1 'Array') (2 'Array')
Debugger
Ready...
Ins NUM
CurObj: out (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
out←(1 'Array') (2 'Array')
Debugger
Ready...
Ins NUM
CurObj: out (Undefined)
⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ We can give it some input to process
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')
⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
out←(1 'Array') (2 'Array')
⎕SHELL⍠'Input' in⍠'Output' out⊢cmd
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

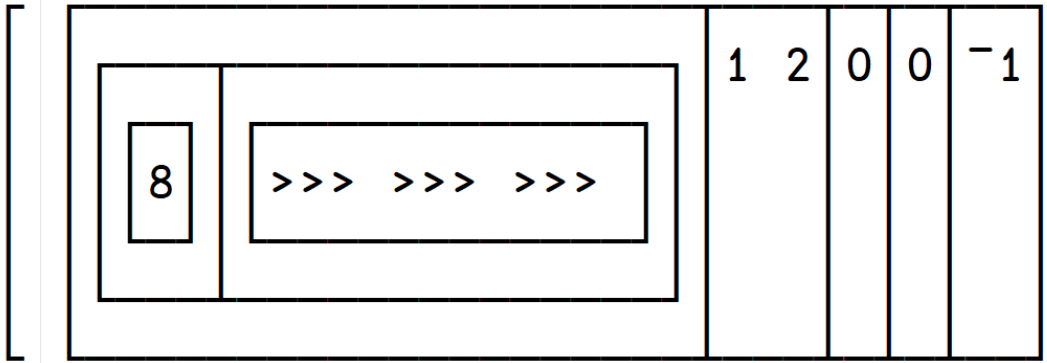
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
in←0 ('Array' ('a=5' 'a+3') 'UTF-8')

⍝ The prompts are annoying, but it turns out
⍝ that they are on standard error.
out←(1 'Array') (2 'Array')
⎕SHELL⍠'Input' in⍠'Output' out⊢cmd
```



Debugger

Ready... Ins NUM

CurObj: cmd (Variable) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

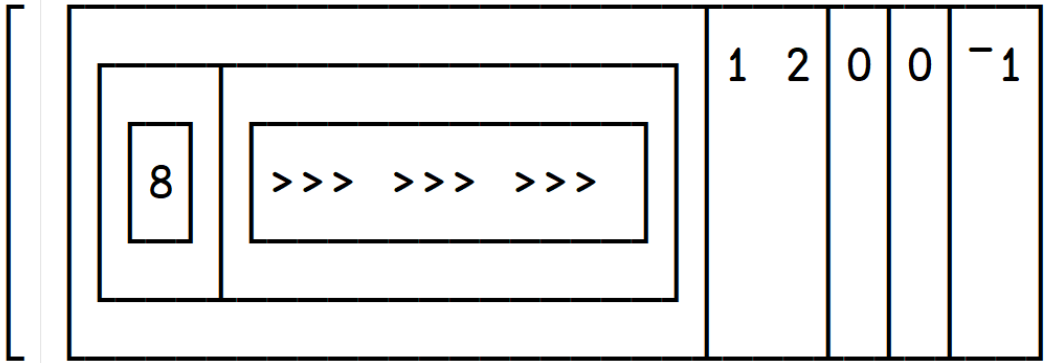
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
      in←0 ('Array' ('a=5' 'a+3') 'UTF-8')

      ⍝ The prompts are annoying, but it turns out
      ⍝ that they are on standard error.
      out←(1 'Array') (2 'Array')
      ⎕SHELL⍠'Input' in⍠'Output' out⊢cmd
```



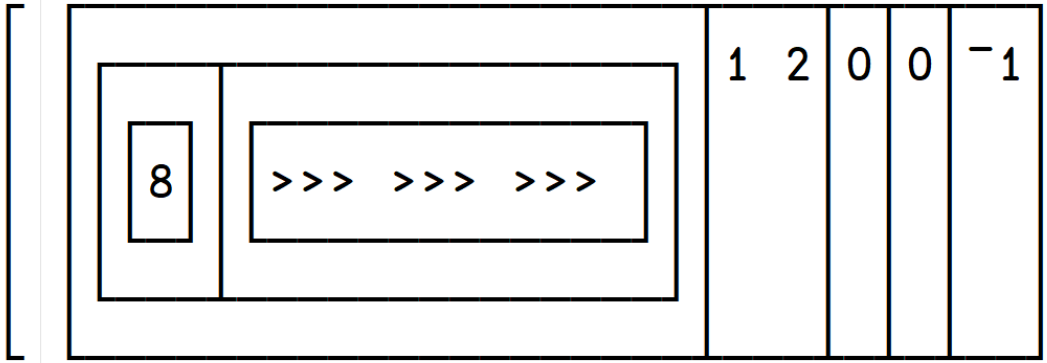

```
      ⍝ Not very interactive..
```

Debugger

Ready... Ins NUM

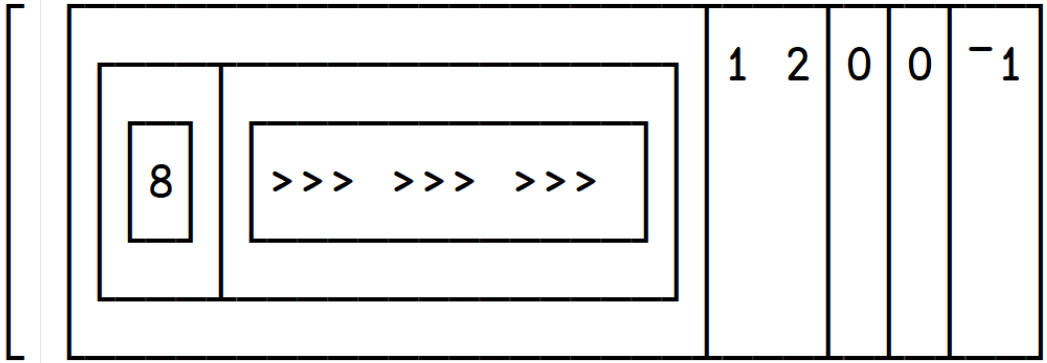
CurObj: cmd (Variable) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

```
      ⍝ The prompts are annoying, but it turns out
      ⍝ that they are on standard error.
      out←(1 'Array') (2 'Array')
      ⎕SHELL⍠'Input' in⍠'Output' out⊢cmd
```




```
      ⍝ Not very interactive..
```

```
      ⍝ The prompts are annoying, but it turns out
      ⍝ that they are on standard error.
      out←(1 'Array') (2 'Array')
      ⎕SHELL⍠'Input' in⍠'Output' out←cmd
```




```
      ⍝ Not very interactive..
      tok←123
```

```
      ⍝ The prompts are annoying, but it turns out
      ⍝ that they are on standard error.
      out←(1 'Array') (2 'Array')
      ⎕SHELL⍠'Input' in⍠'Output' out⊢cmd
```

8	>>> >>> >>>	1	2	0	0	¯1

```
      ⍝ Not very interactive..
      tok←123
```

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
      tok←123
      in←0 ('Token' tok)
```

Debugger

Ready... Ins NUM

CurObj: cmd (Variable) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

CLEAR WS - Dyalog APL/W-64

File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit

WS Object Tool Edit Session APL385 Unicode 56

Language Bar

```
tok←123
in←0 ('Token' tok)
```

Debugger

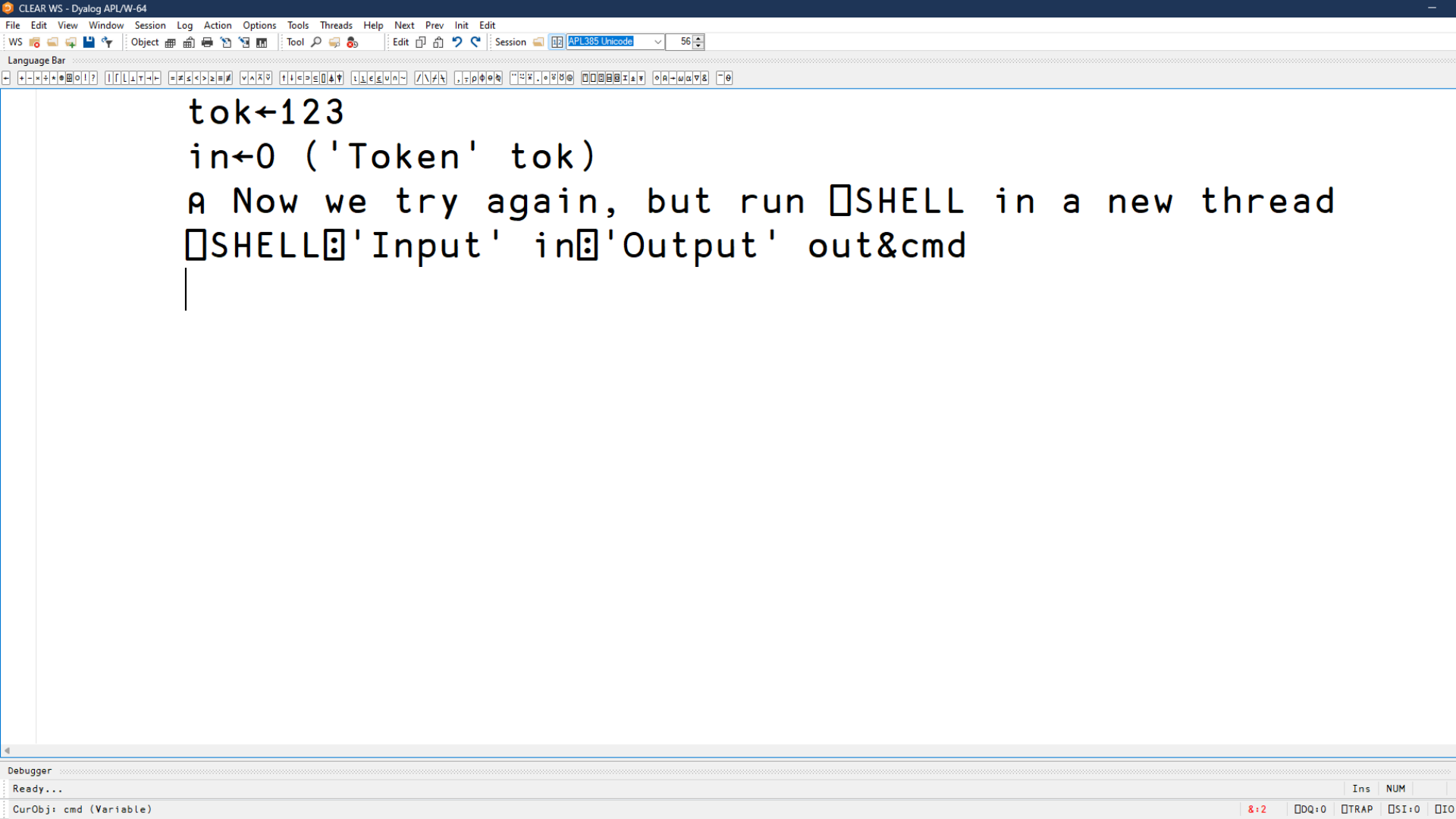
Ready... Ins NUM

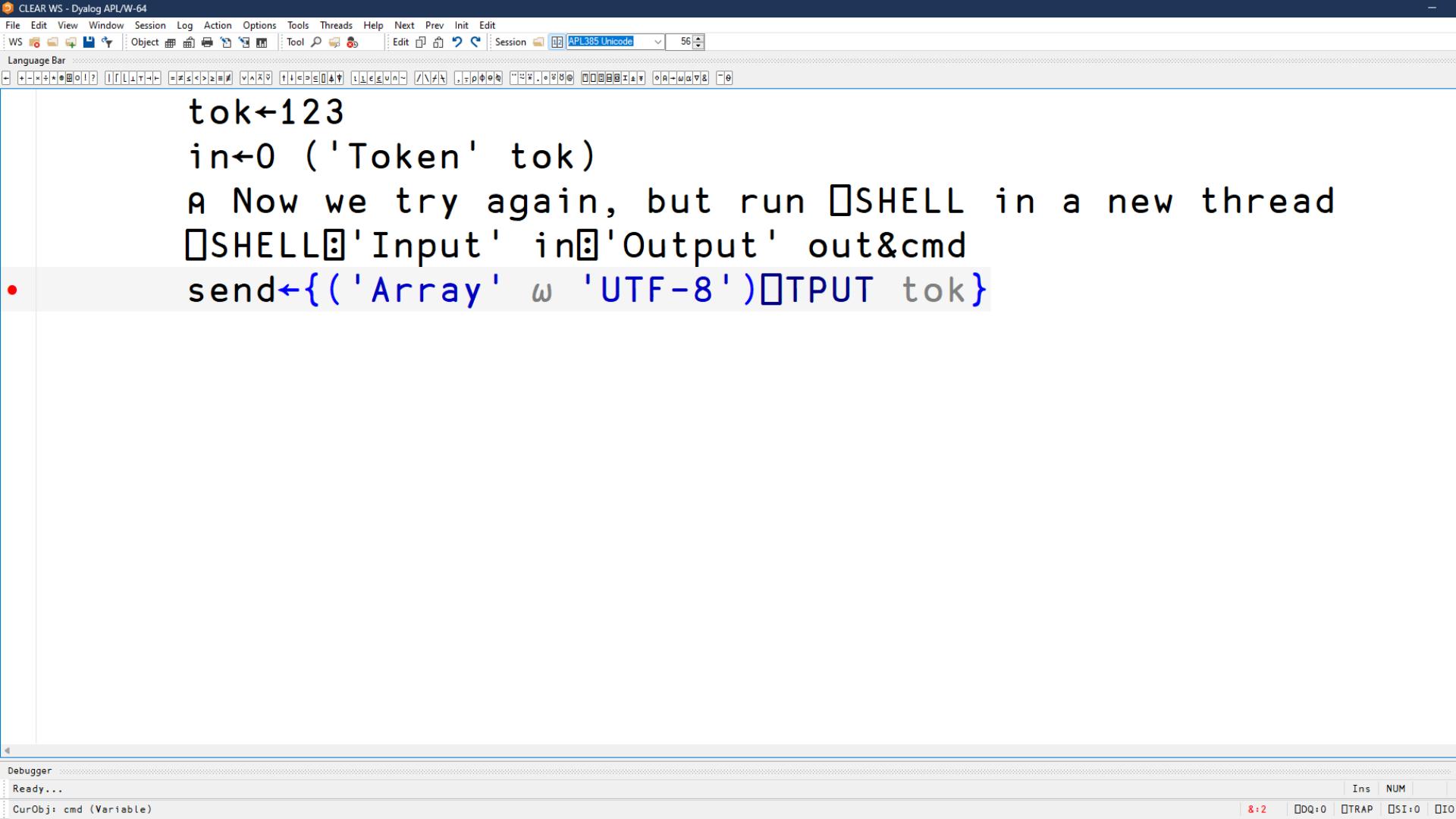
CurObj: cmd (Variable) &:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

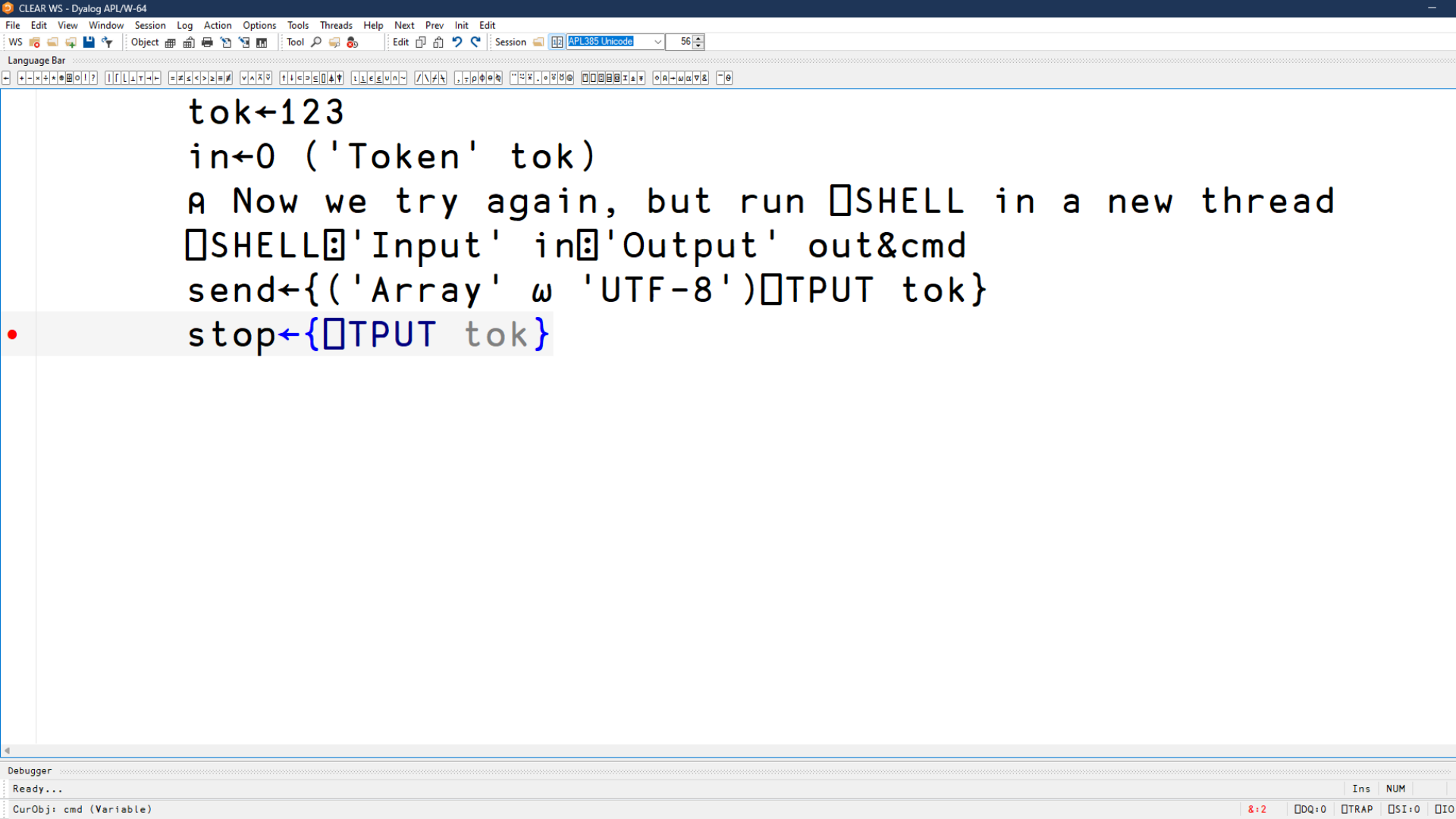
CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
Debugger
Ready...
Ins NUM
CurObj: thread (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

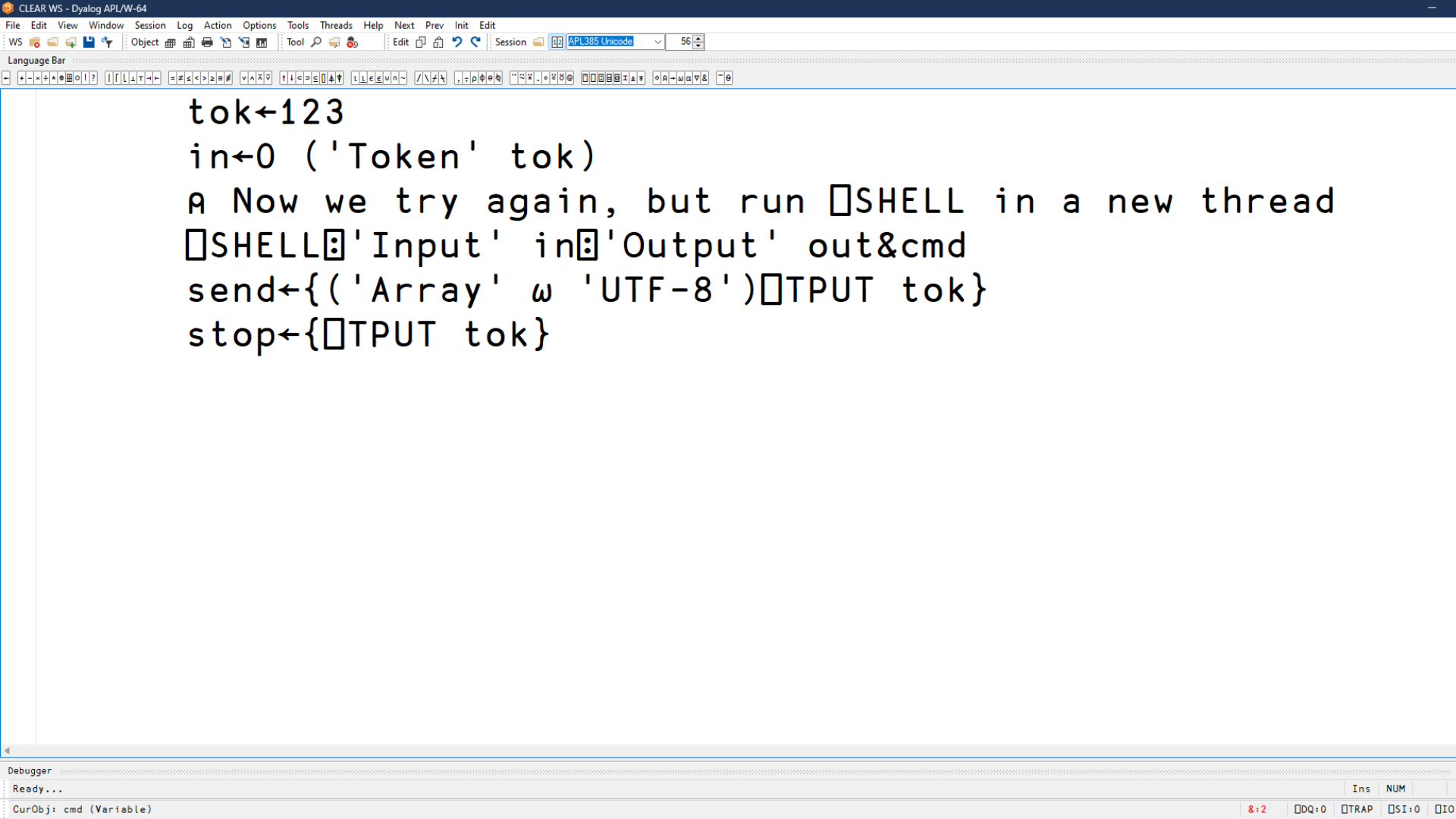
CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⎕NEW 'Token' tok
⍝ Now we try again, but run ⎕SHELL in a new thread
Debugger
Ready...
Ins NUM
CurObj: thread (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

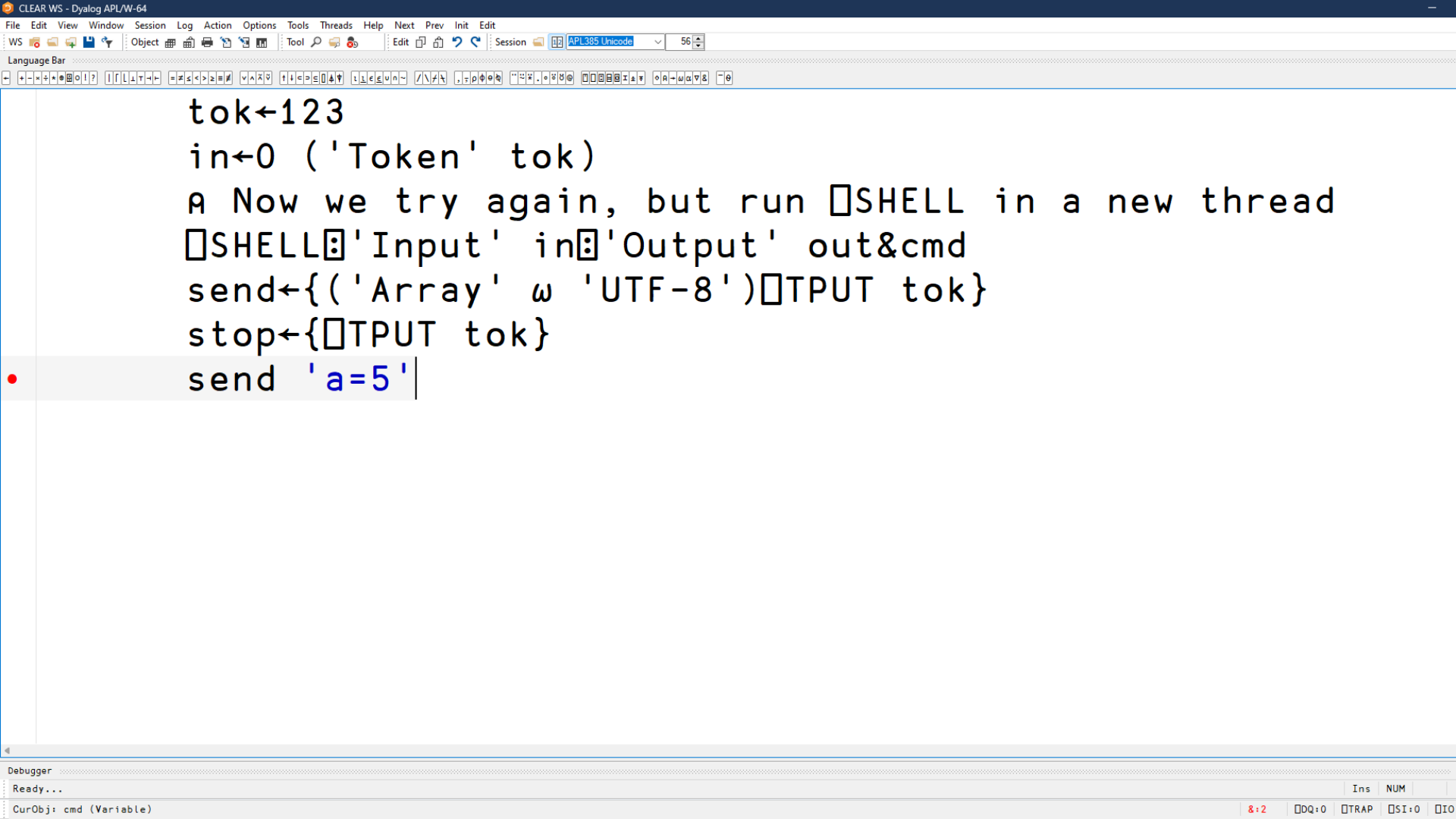
CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⎕NEW ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

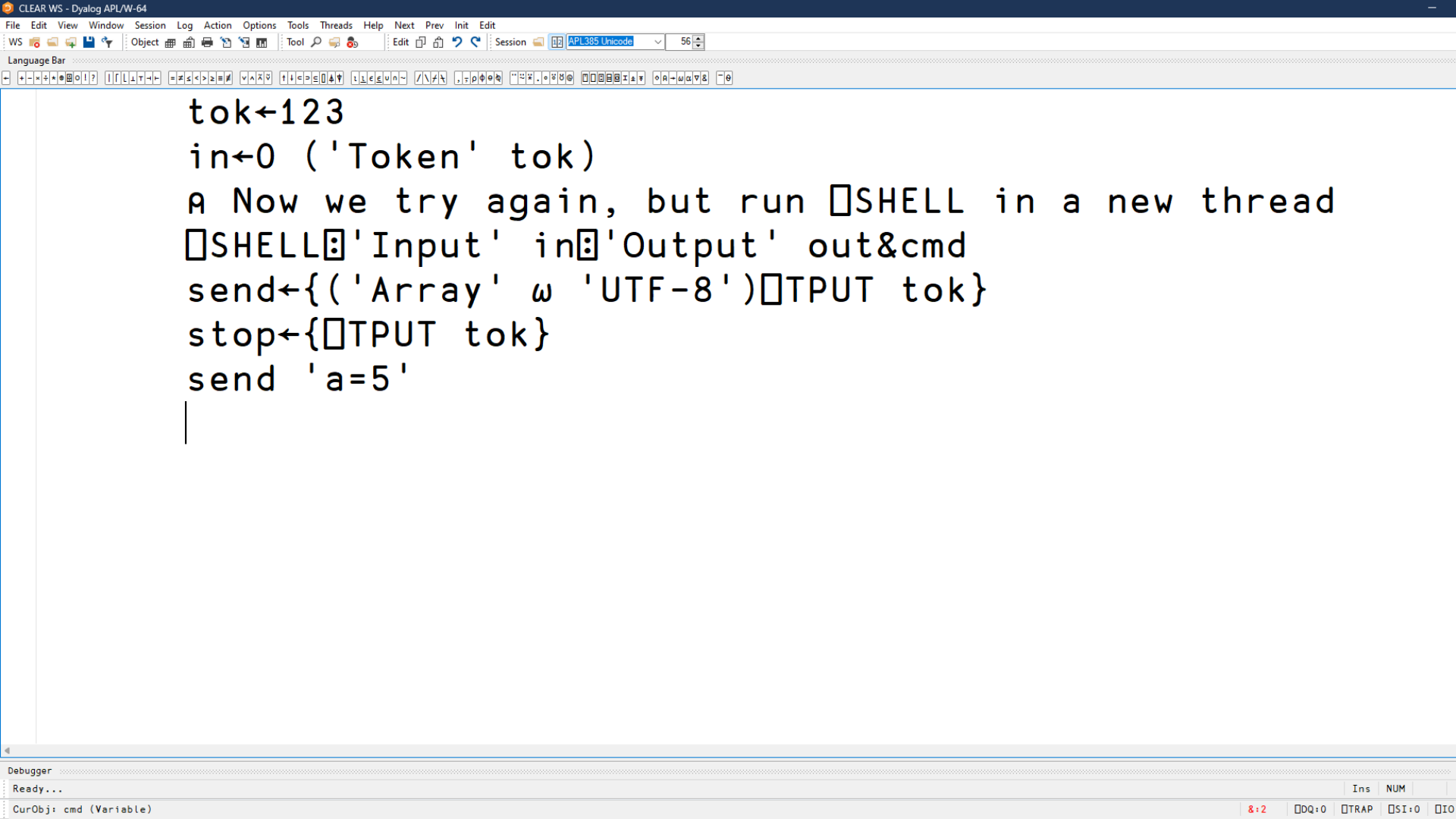

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎ ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

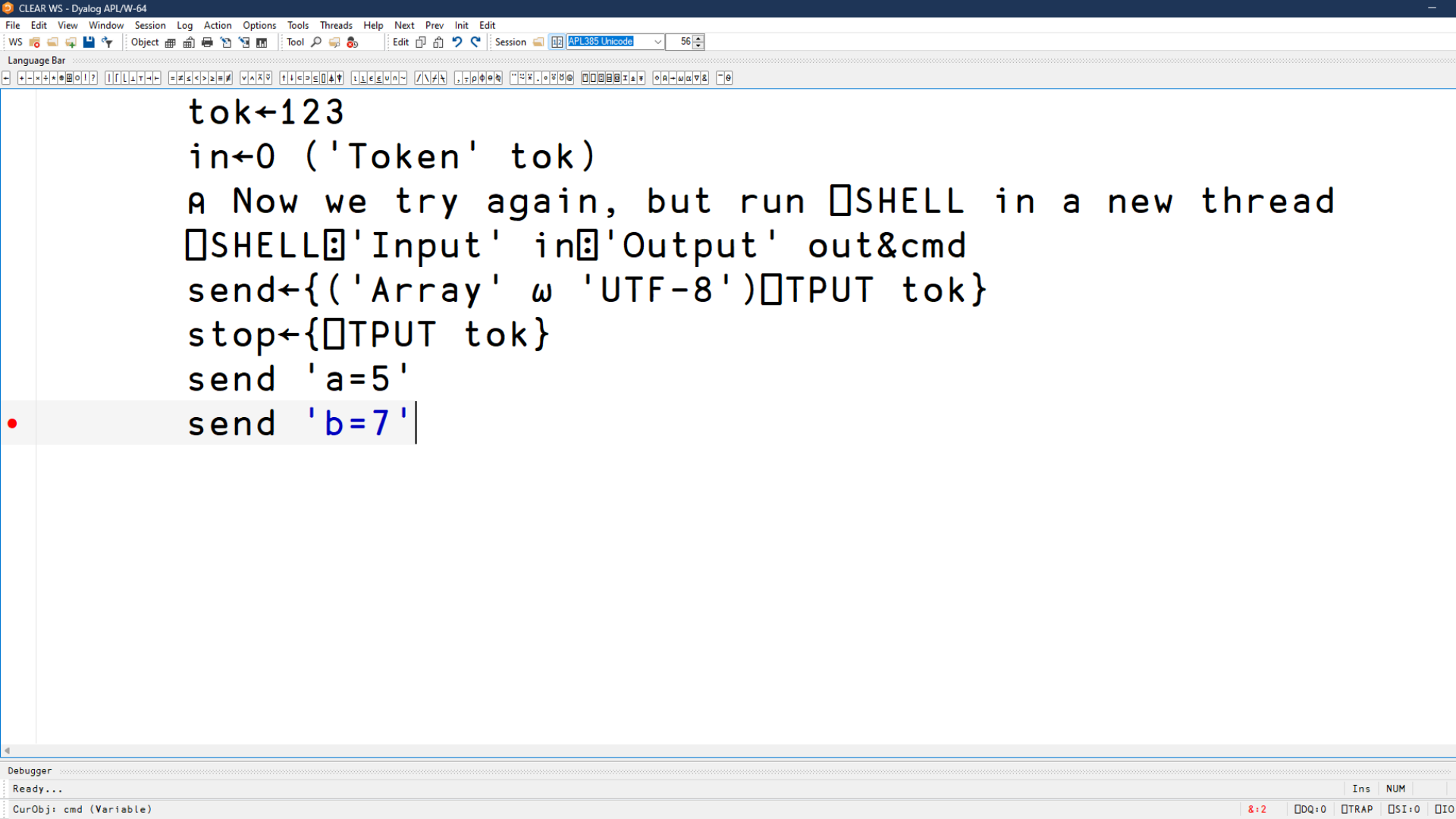

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

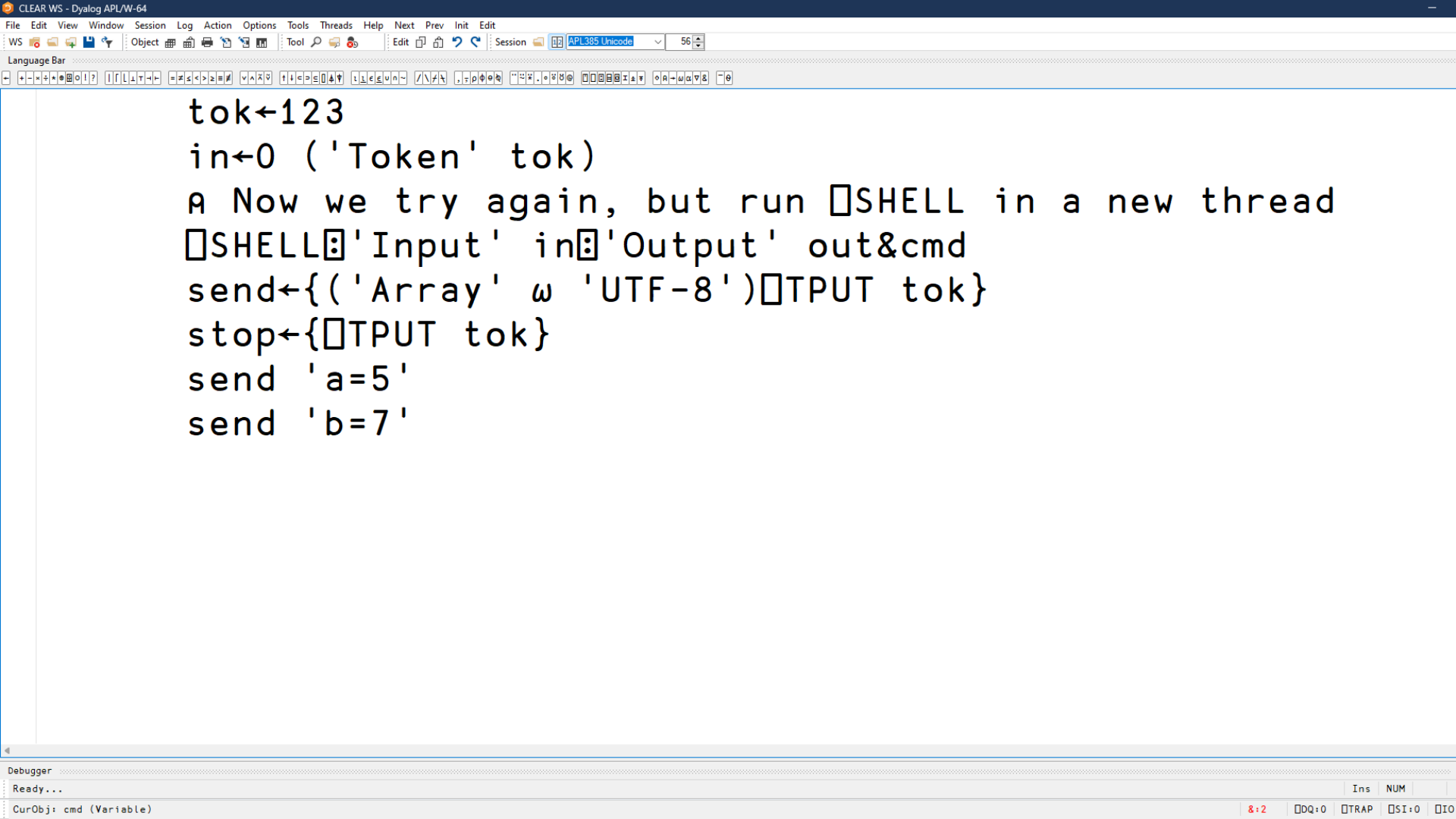

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

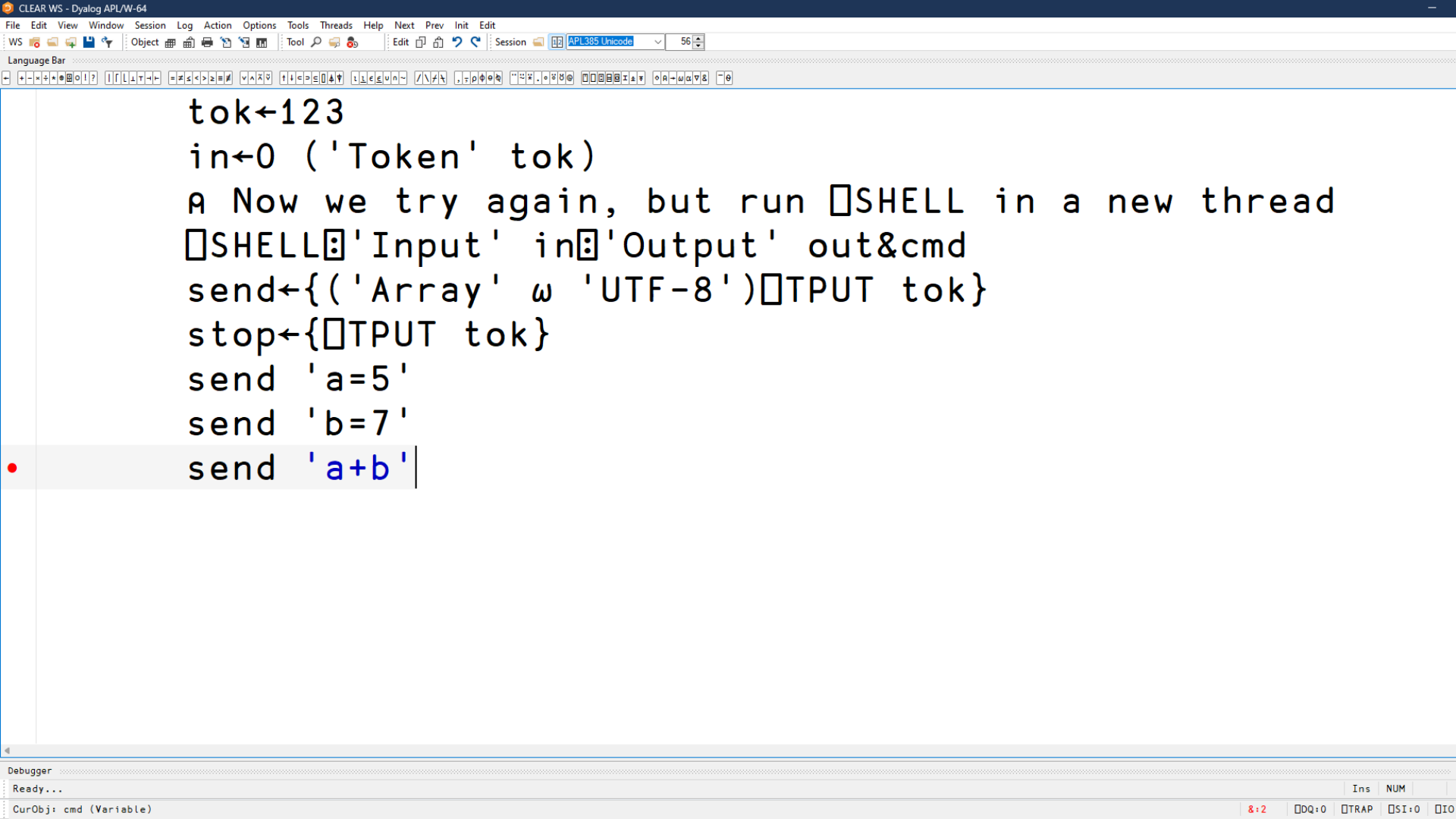

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⎕NEW ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

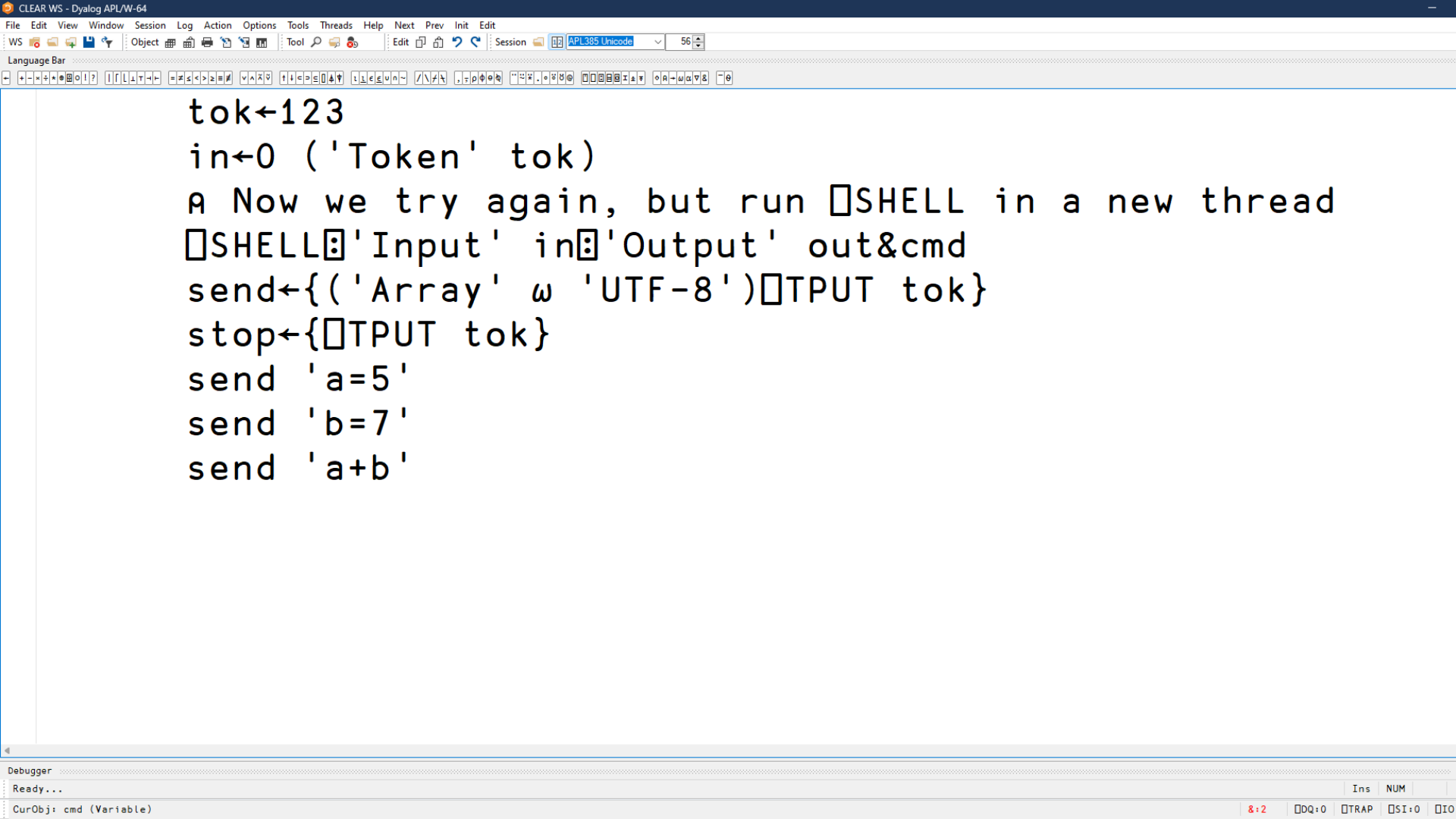

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⎕NEW ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

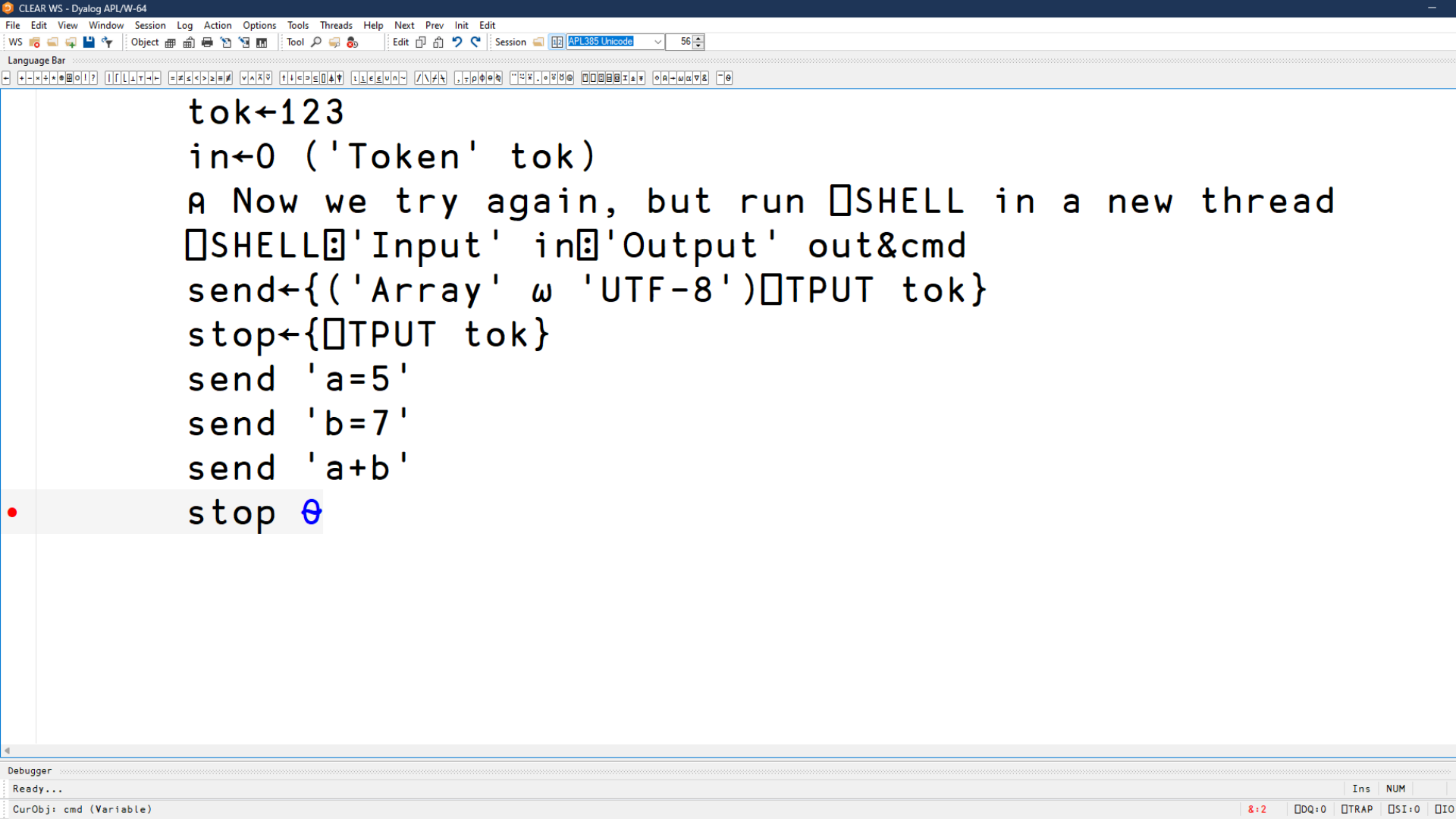

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

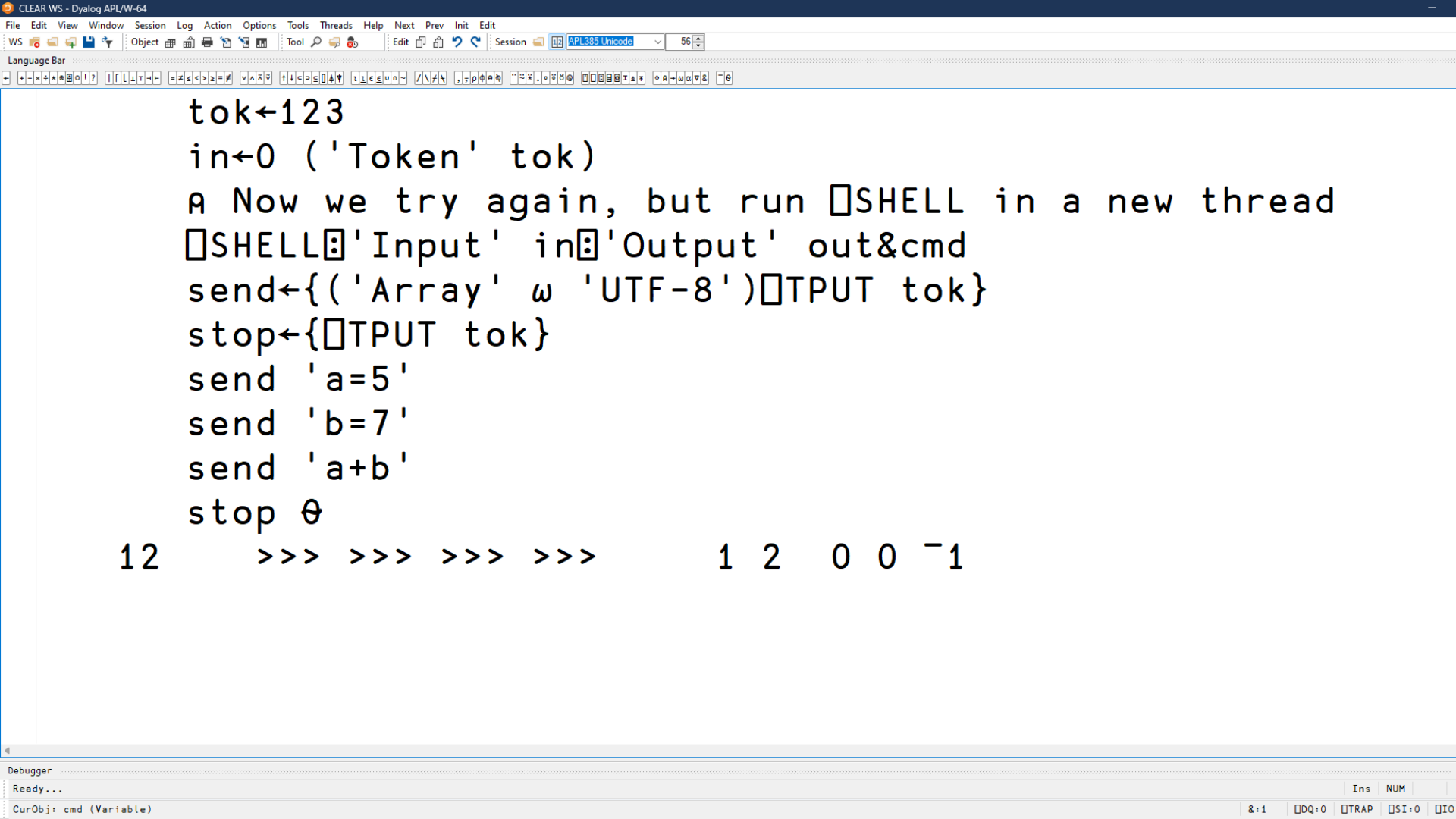

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍬ ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

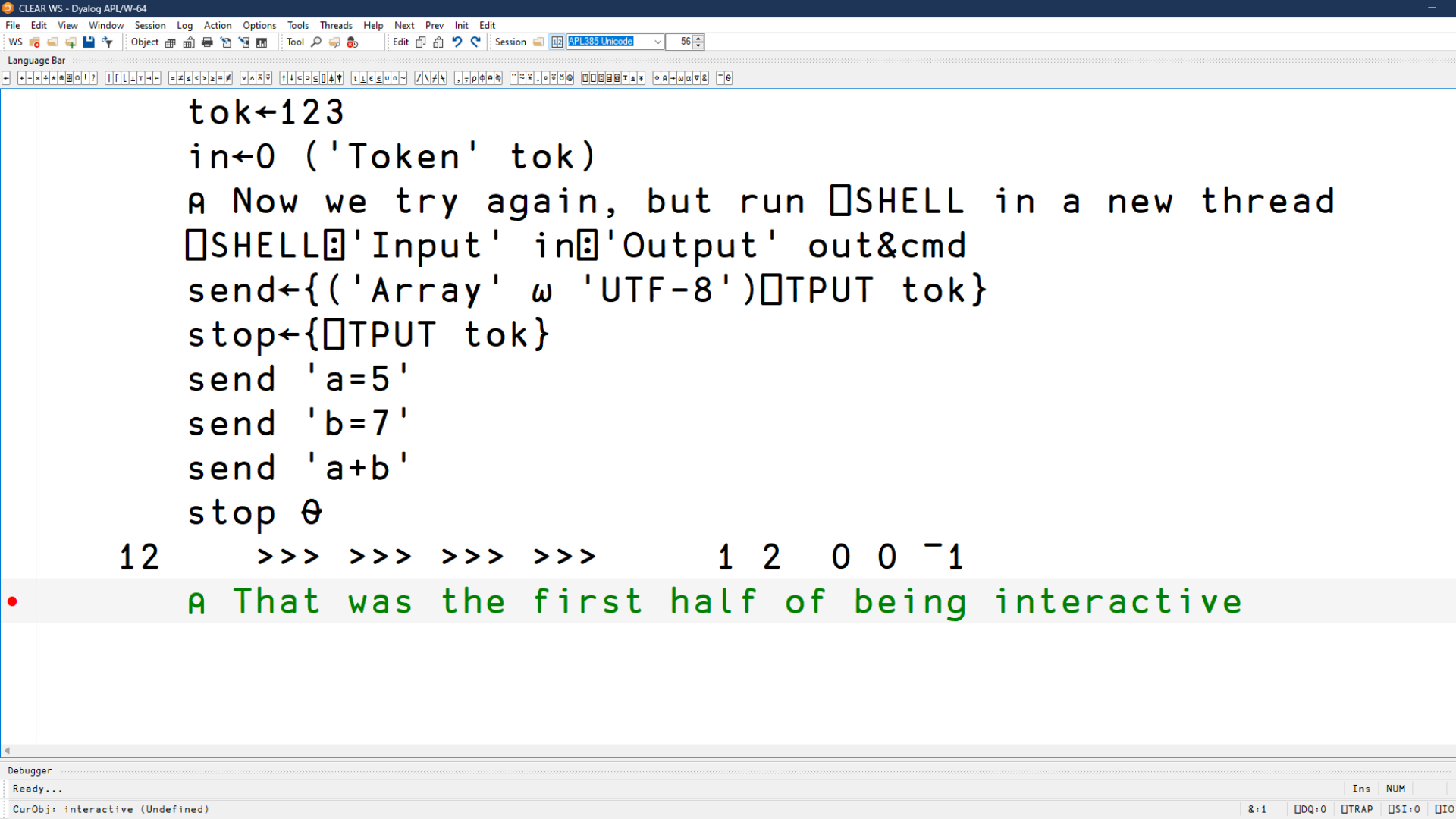

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⎕NEW ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

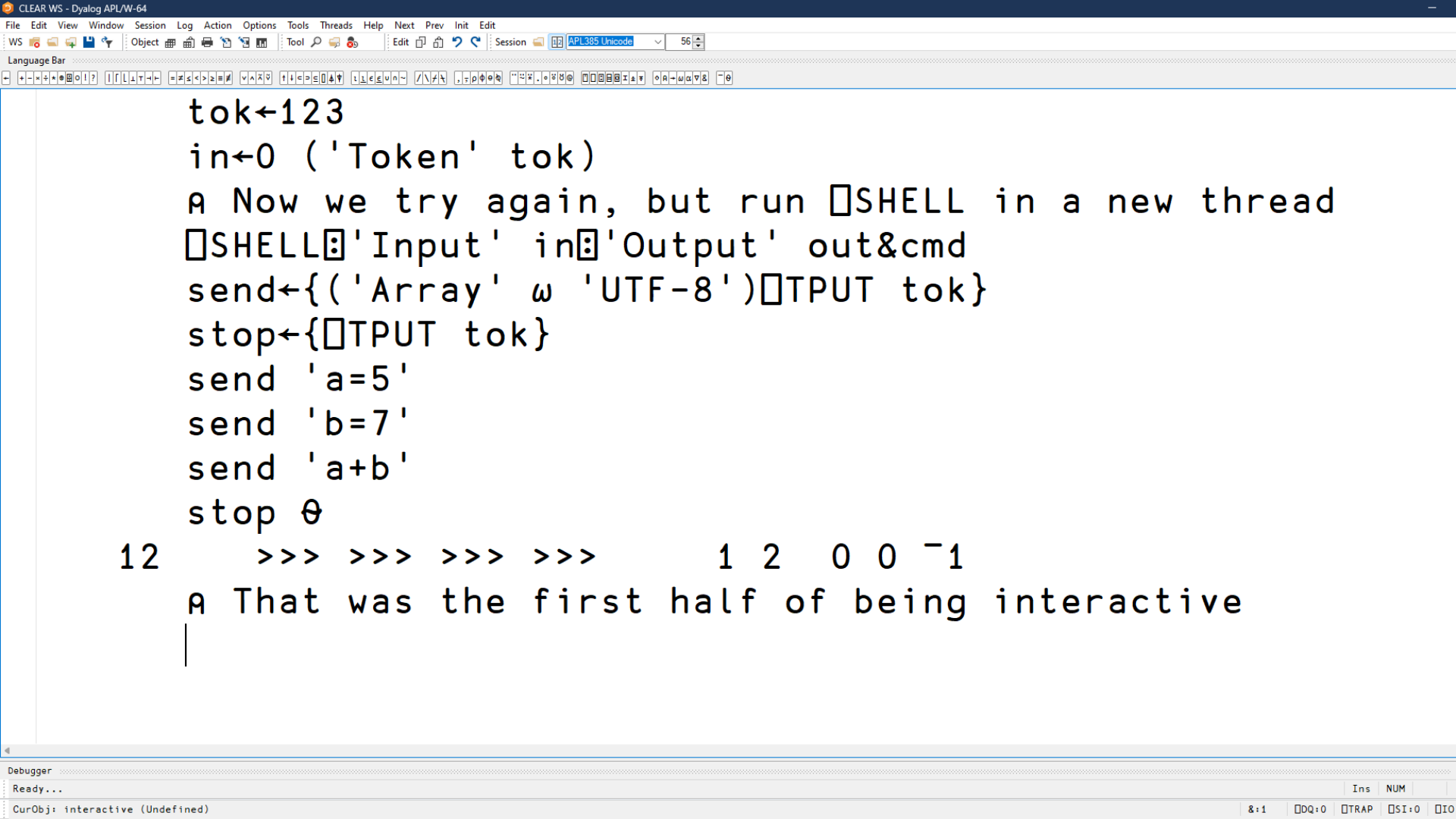

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

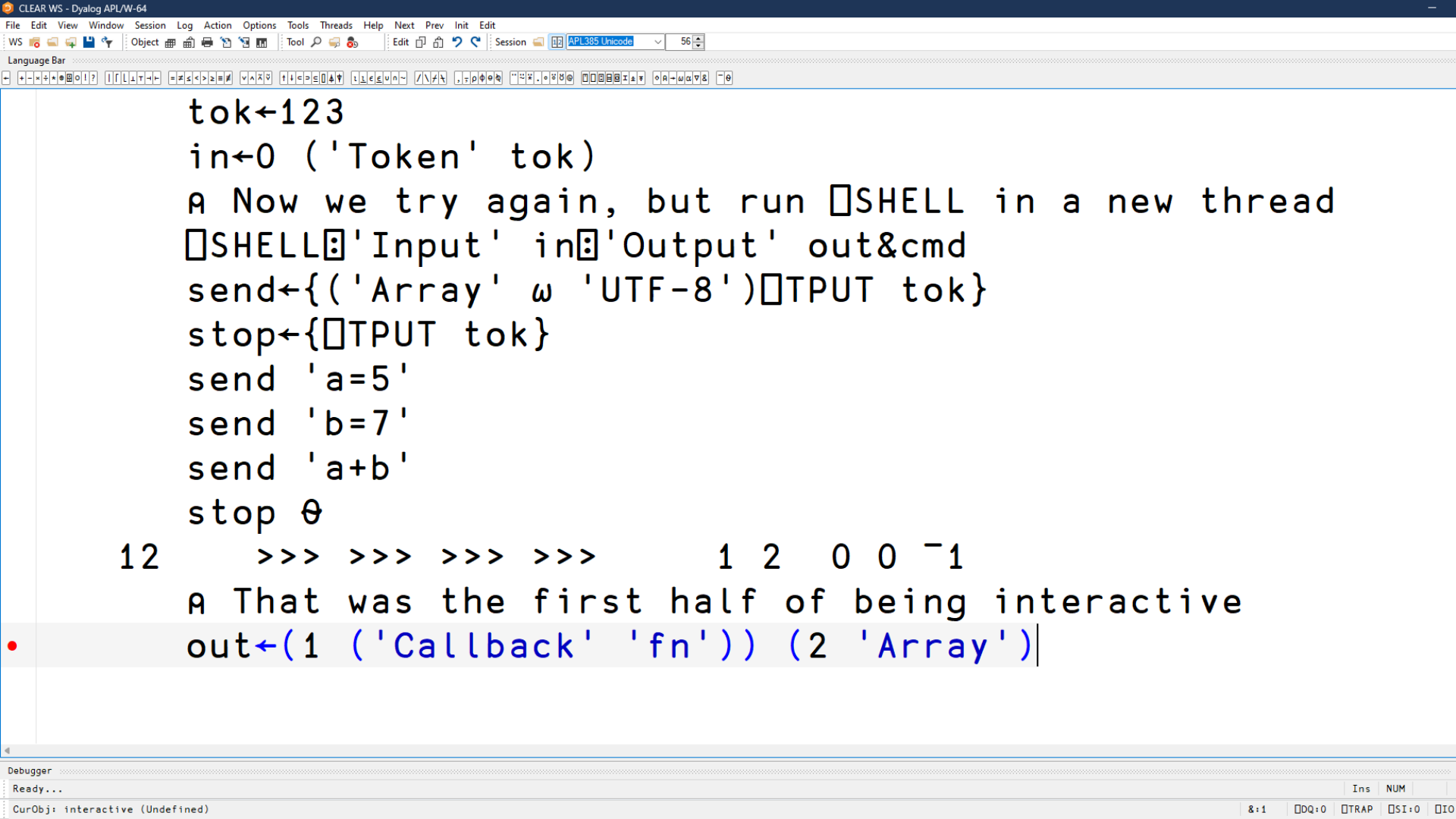

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

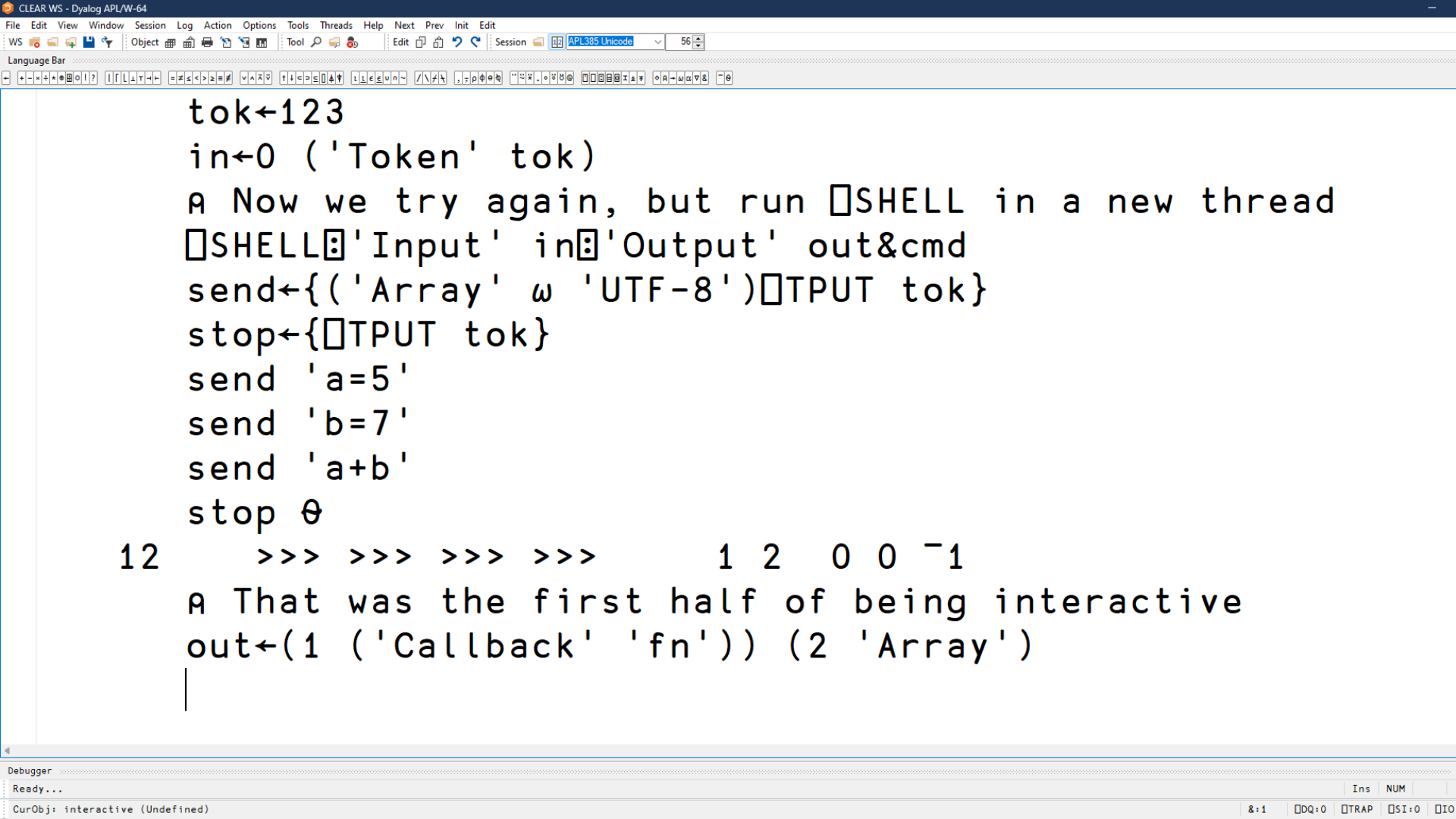

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop 0
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

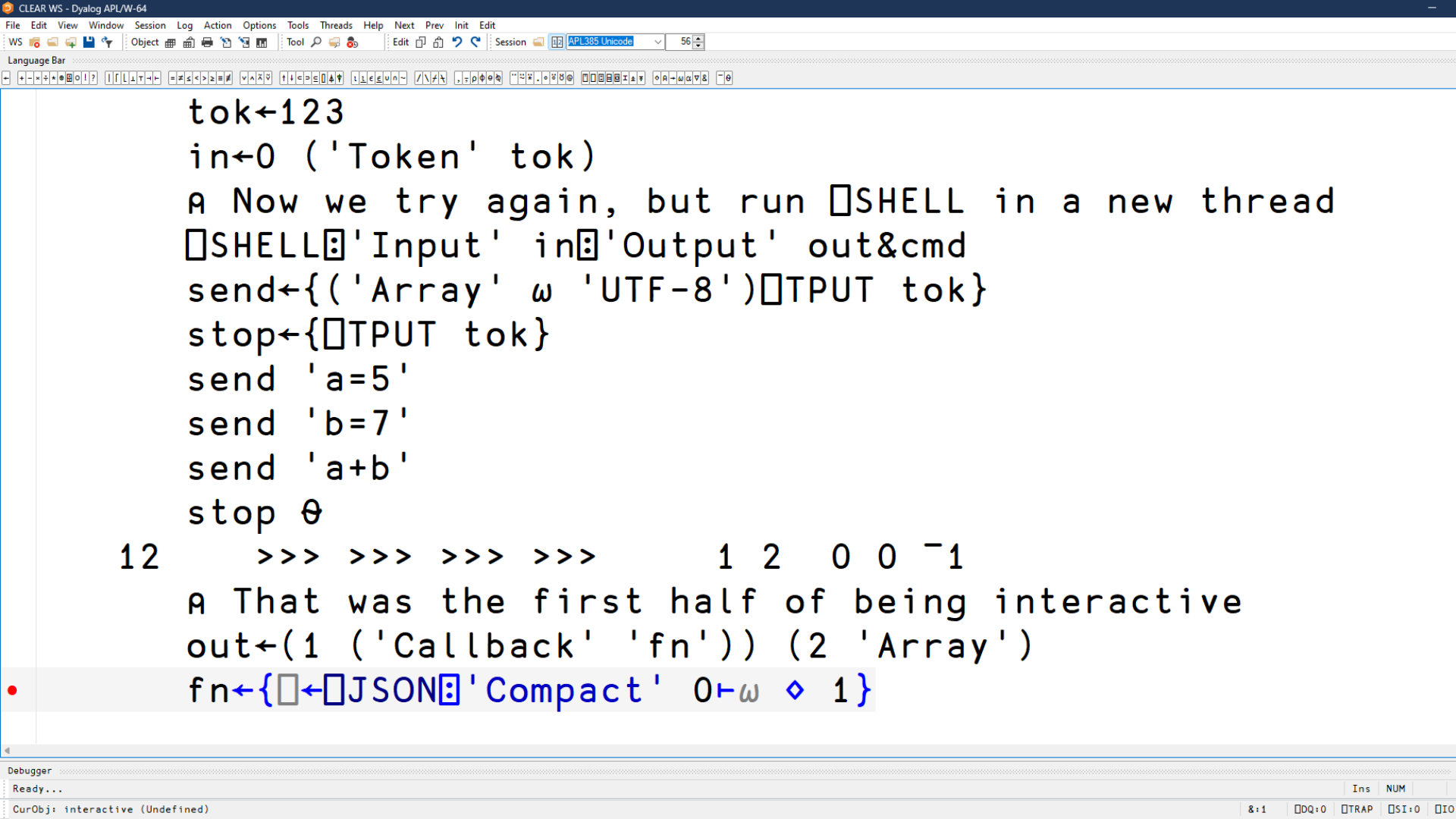

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop 0
12 >>> >>> >>> >>> 1 2 0 0 ¯1
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

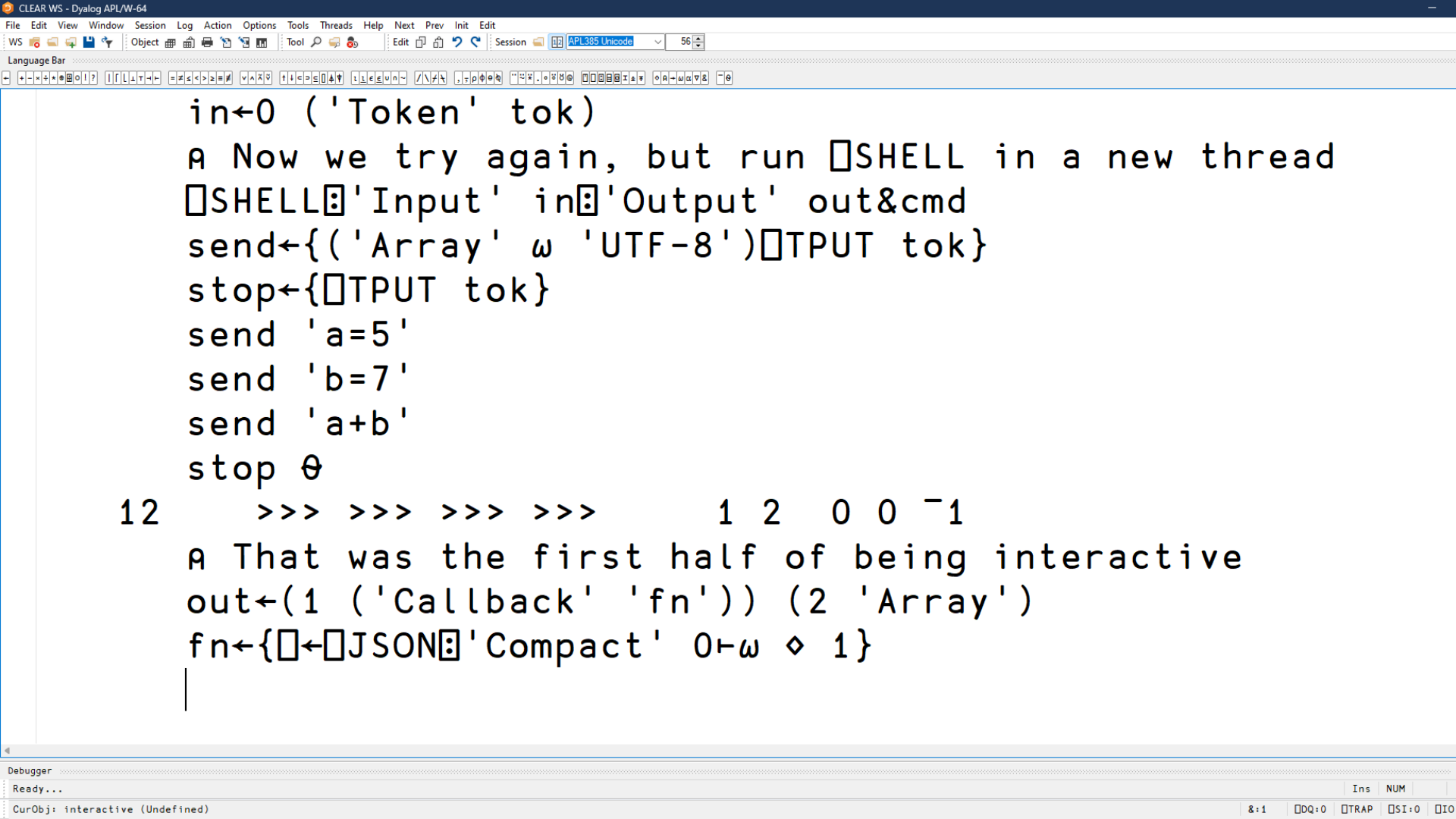

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍬ ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

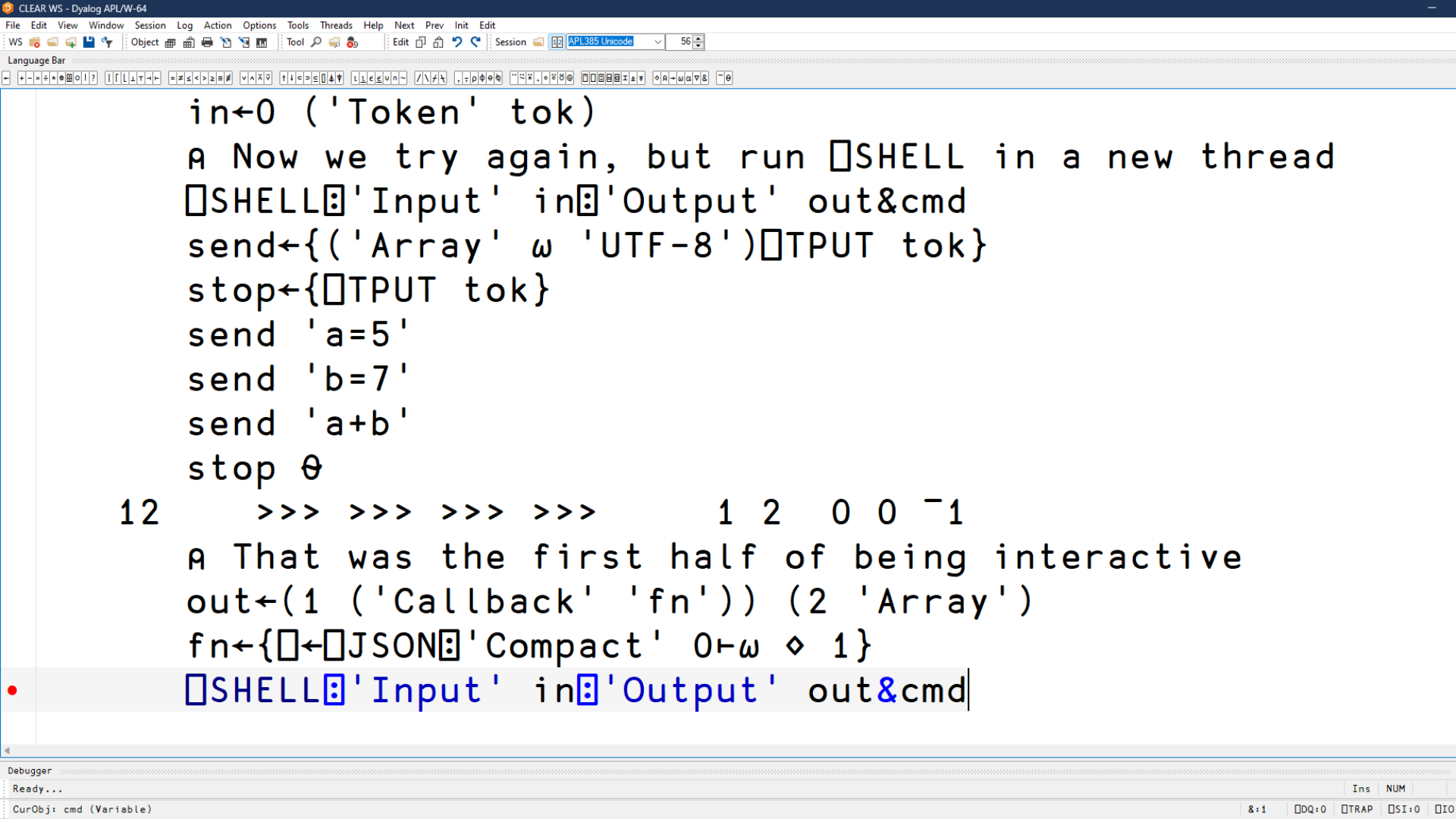

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍎0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

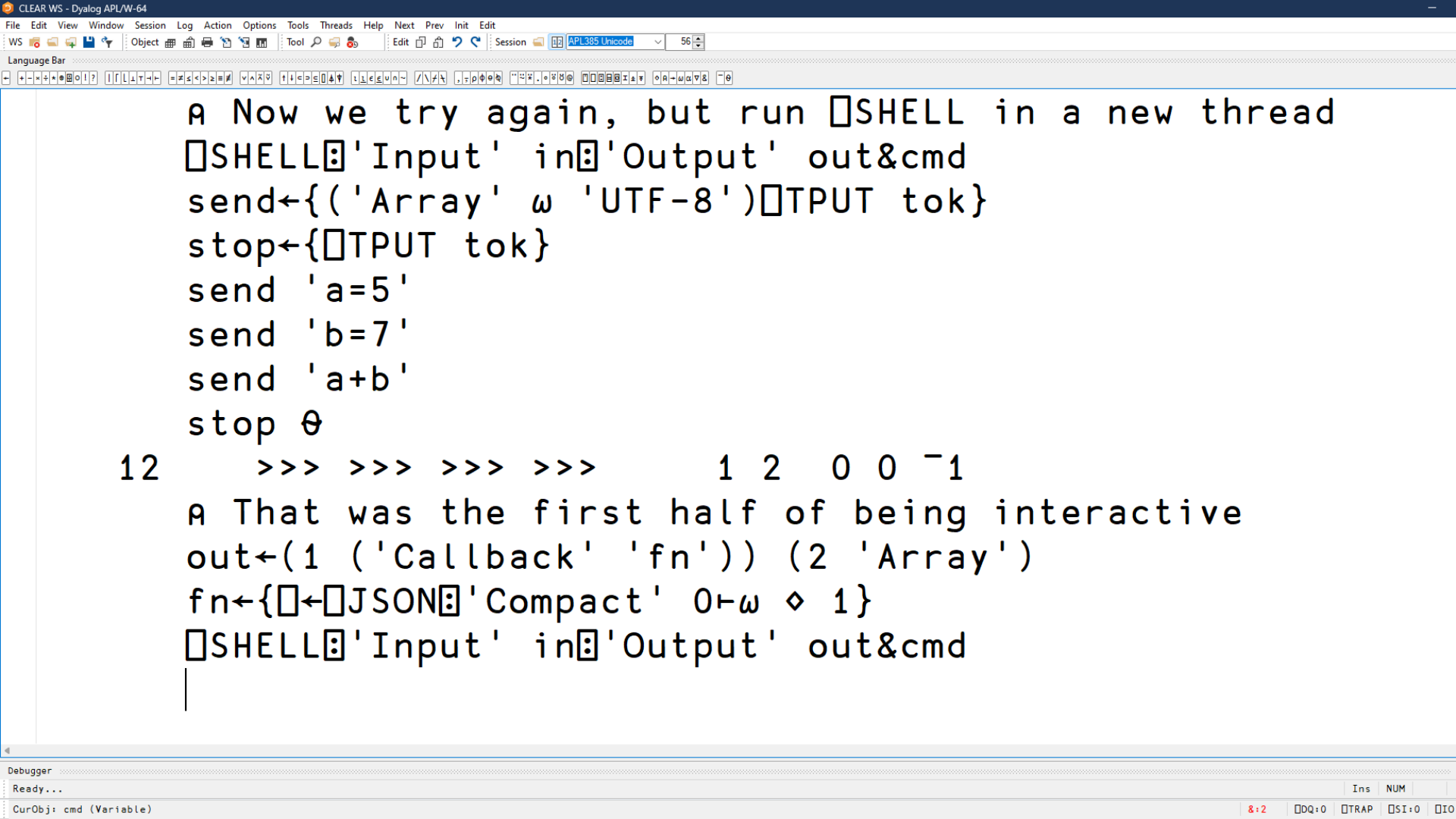

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
Language Bar
tok←123
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)

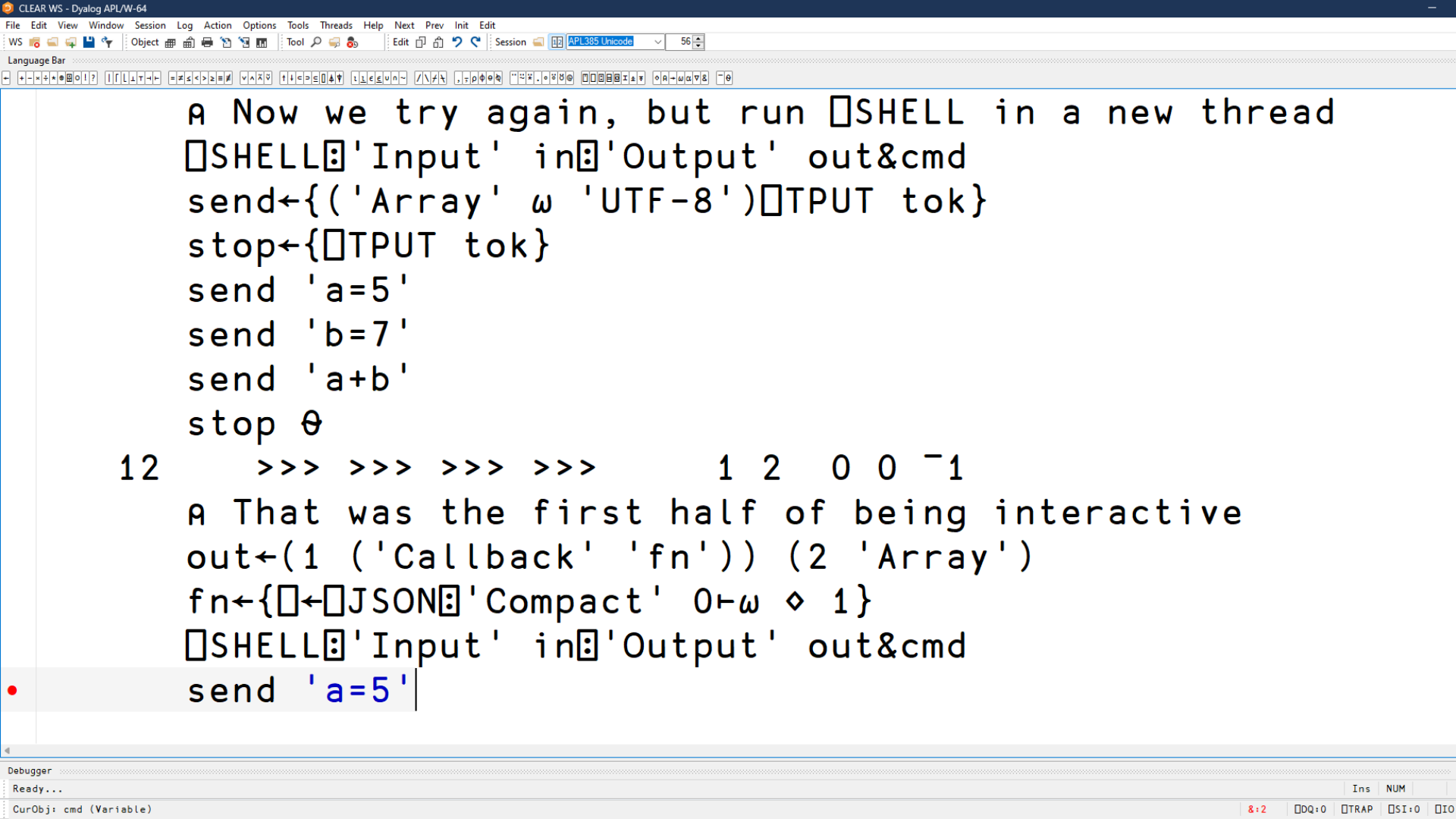

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
tok←123
in←⍬ ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

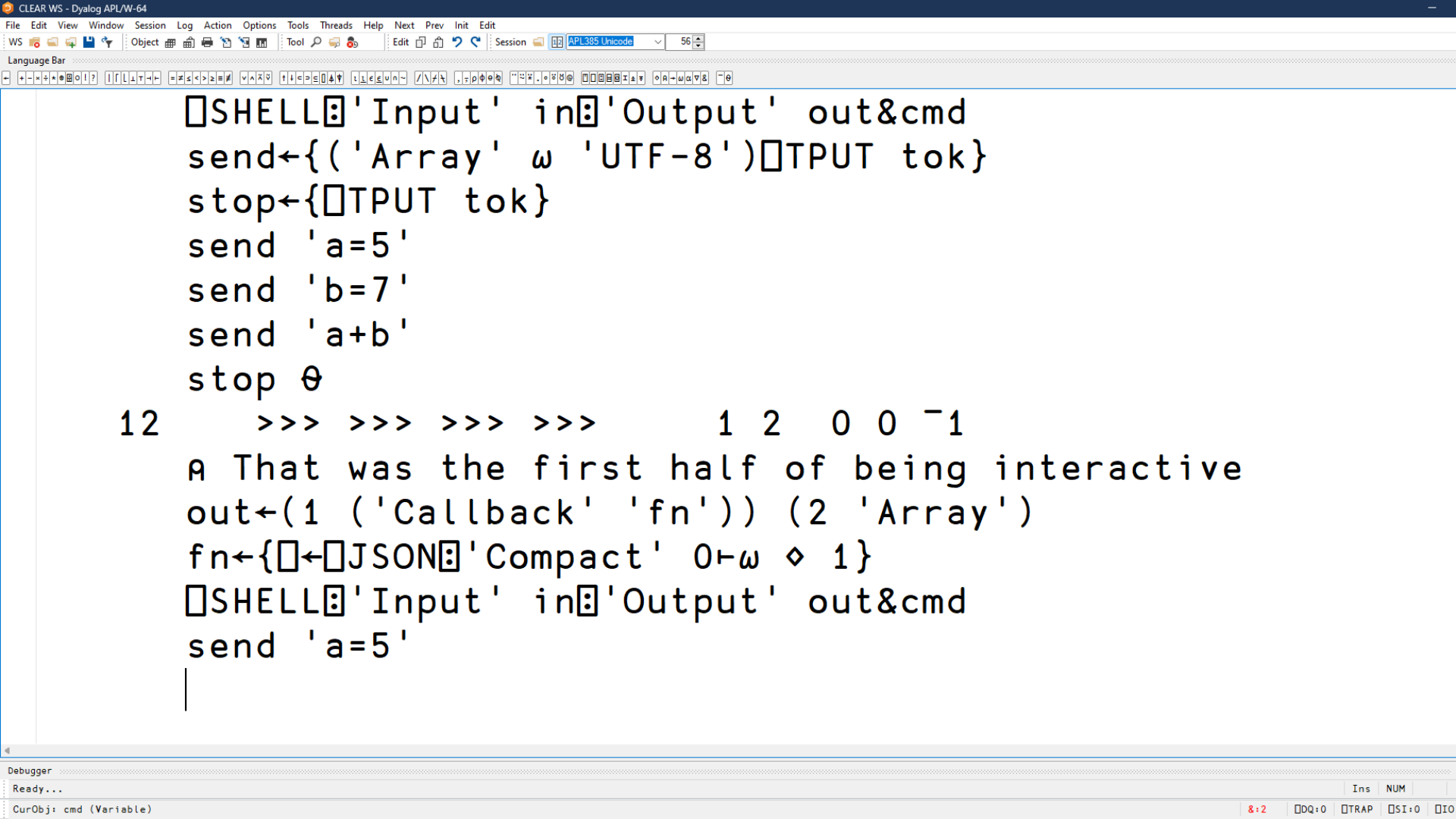

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
Language Bar
tok←123
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

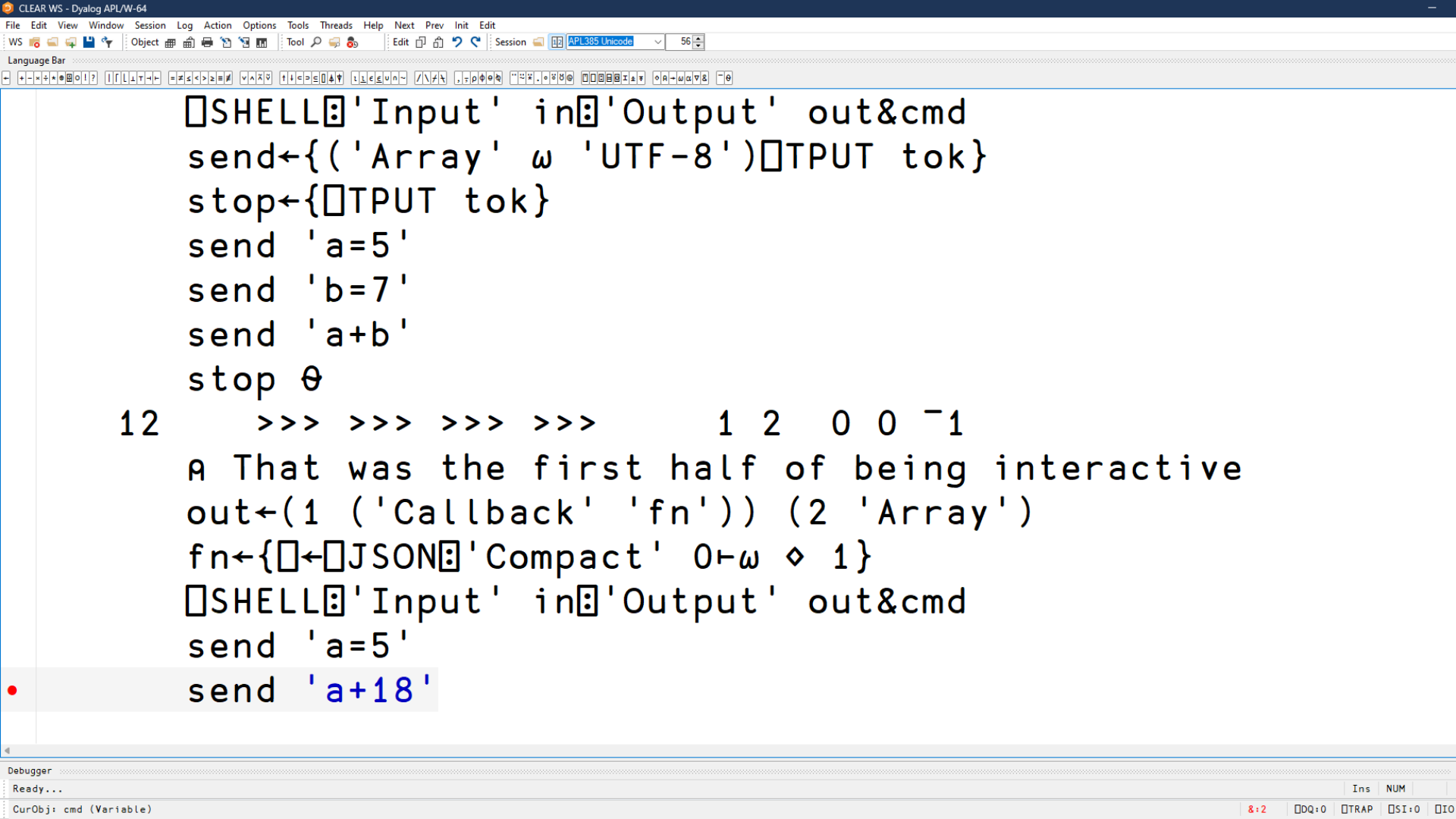

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
Debugger
Ready...
Ins NUM
CurObj: interactive (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

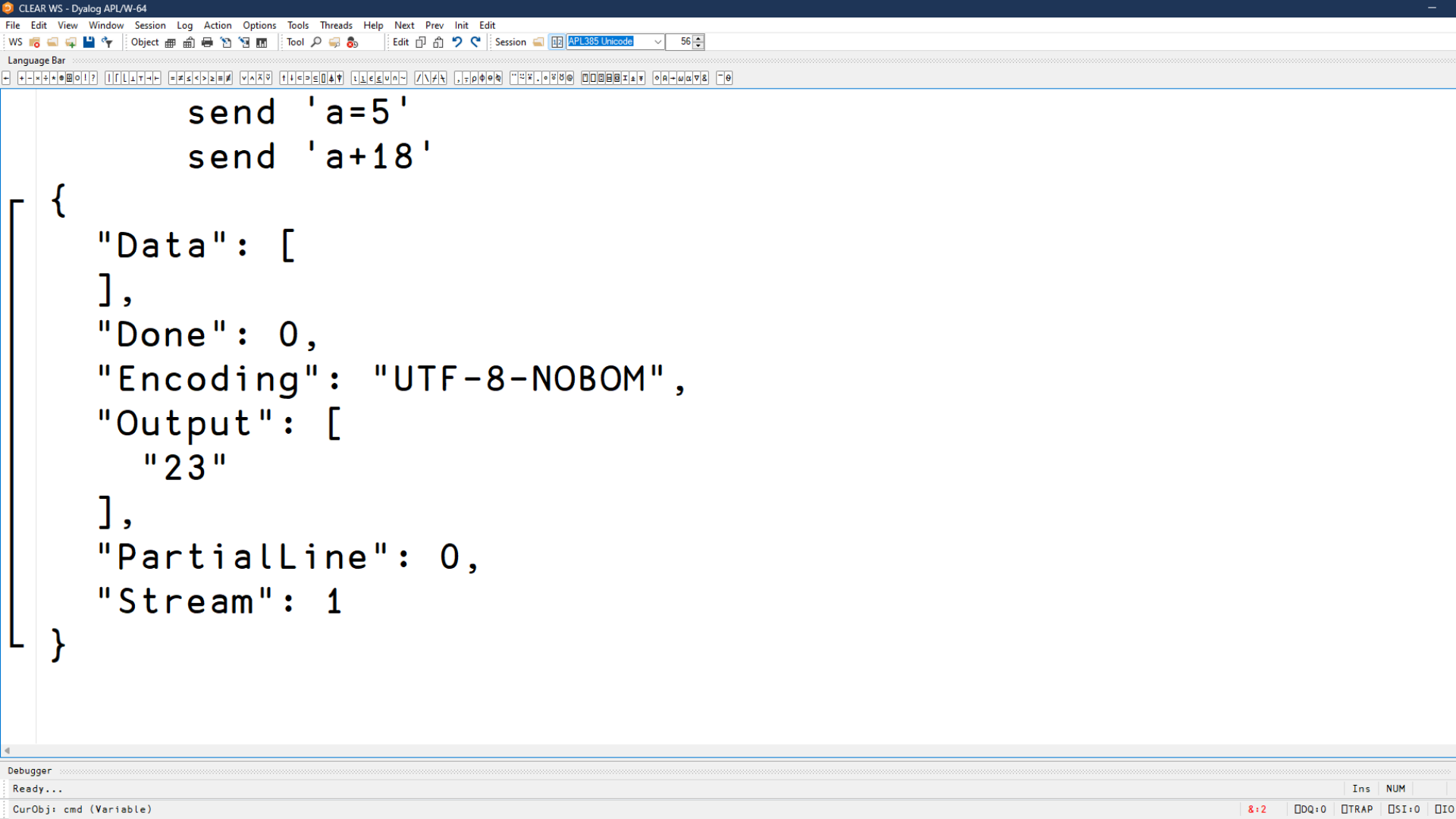

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
in←0 ('Token' tok)
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
⎕SHELL⍠'Input' in⍠'Output' out&cmd
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

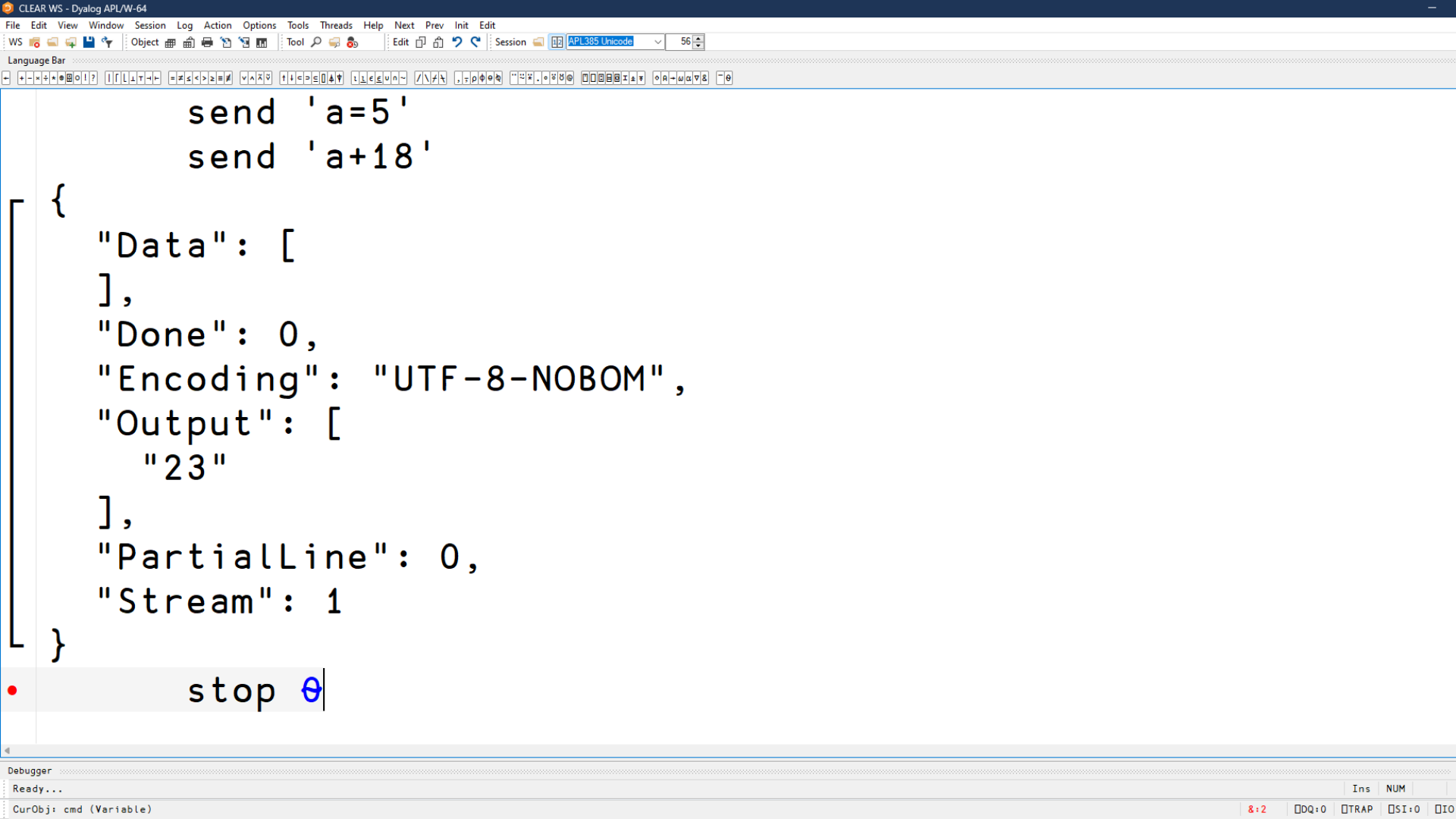

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
⎕SHELL⍠'Input' in⍠'Output' out&cmd
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

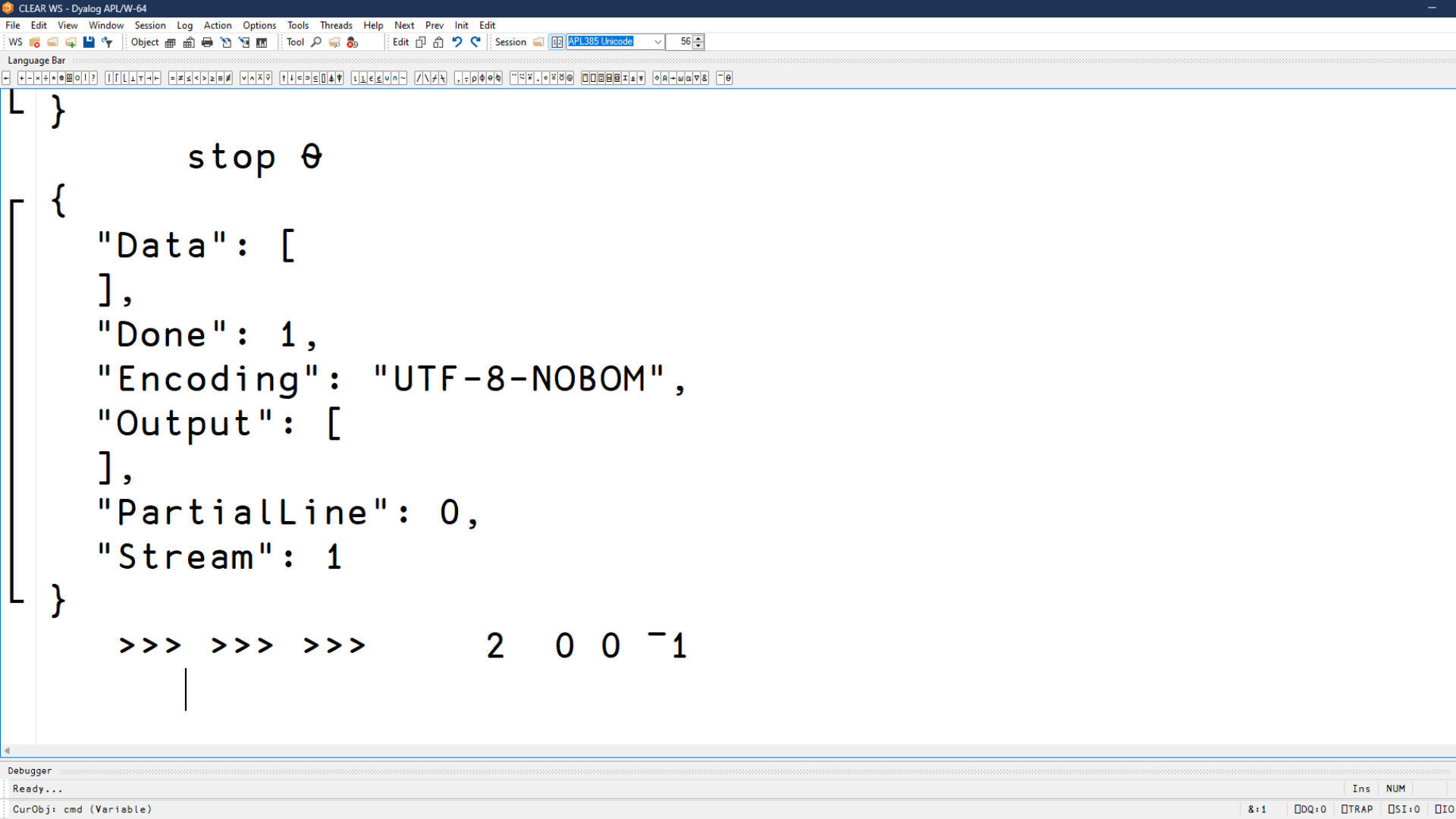

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⍝ Now we try again, but run ⎕SHELL in a new thread
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

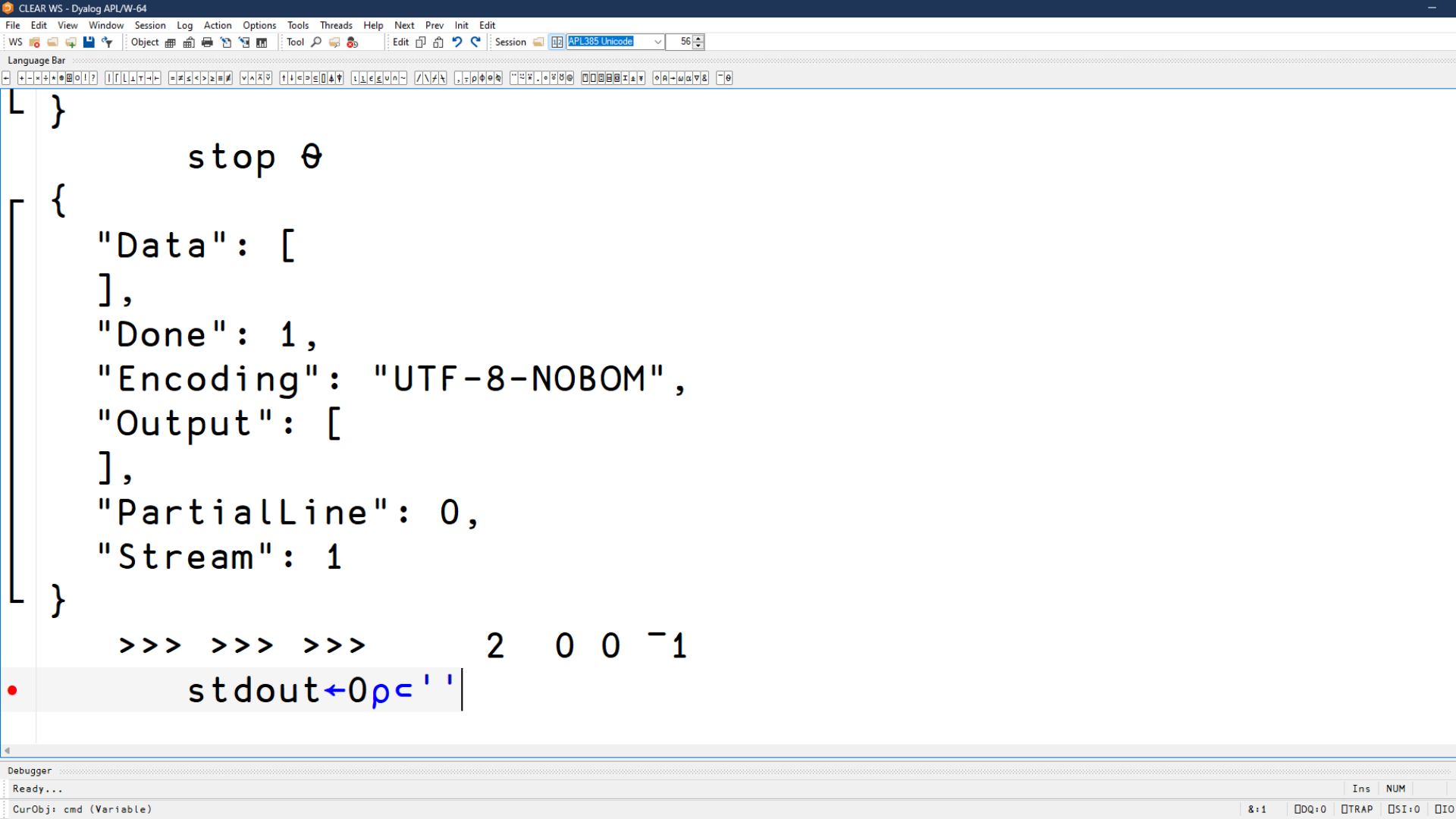

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop 0
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

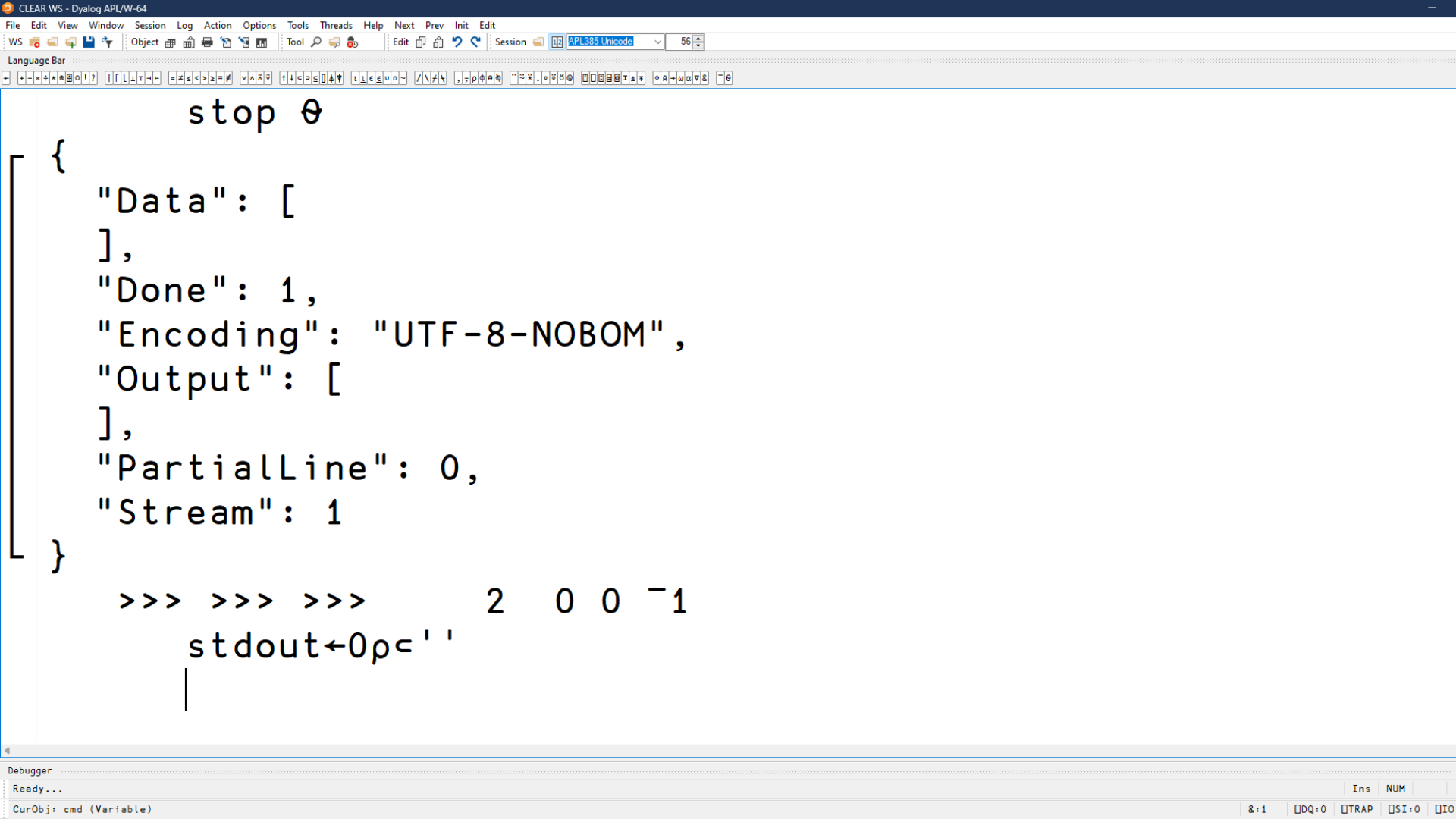

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send←{('Array' ⍵ 'UTF-8')⎕TPUT tok}
stop←{⎕TPUT tok}
send 'a=5'
send 'b=7'
send 'a+b'
stop ⍬
12 >>> >>> >>> >>> 1 2 0 0 ¯1
⍝ That was the first half of being interactive
out←(1 ('Callback' 'fn')) (2 'Array')
fn←{⎕←⎕JSON⍠'Compact' 0⊢⍵ ⋄ 1}
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'a+18'
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

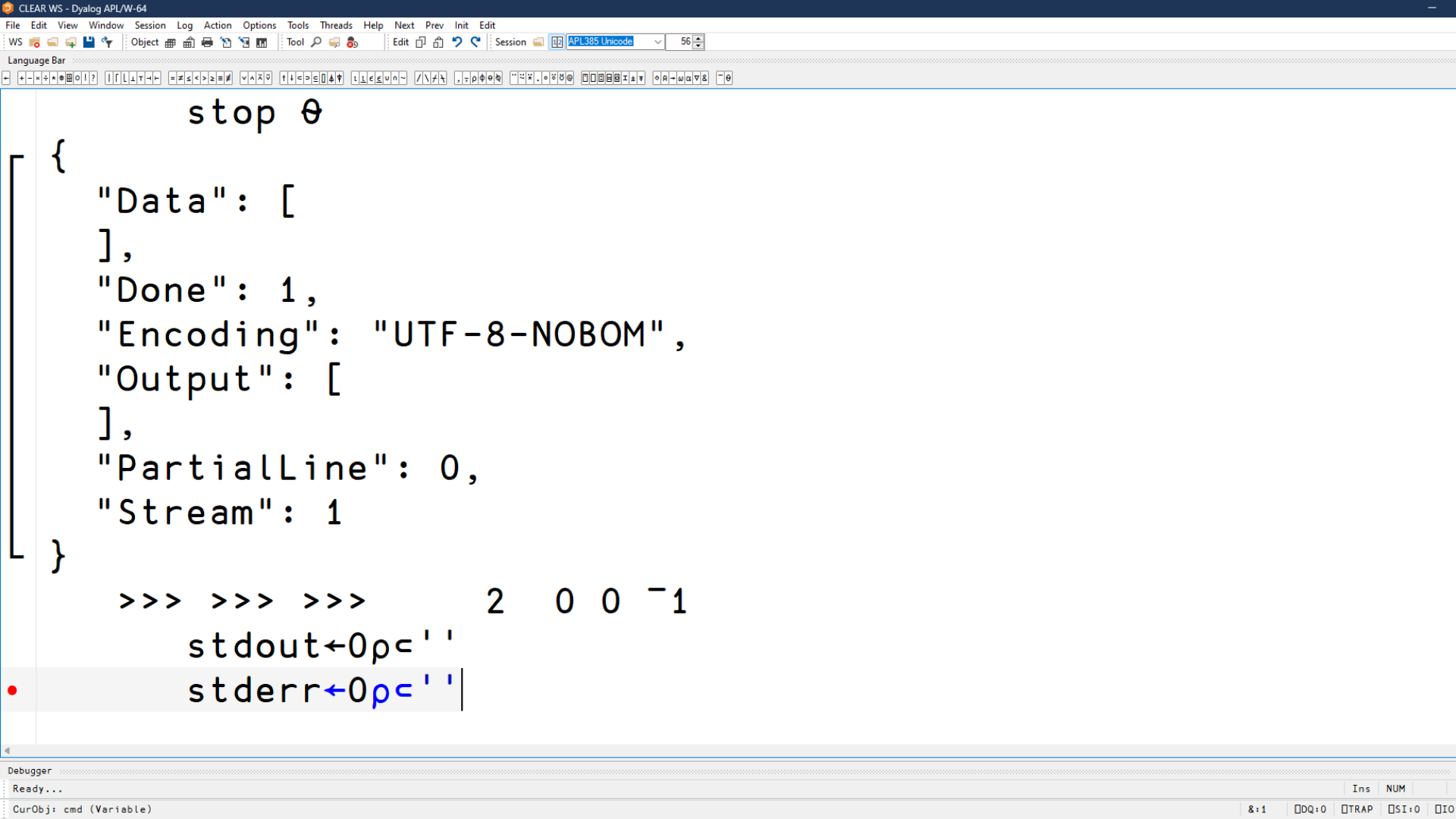

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
send 'a=5'
send 'a+18'
{
"Data": [
],
"Done": 0,
"Encoding": "UTF-8-NOBOM",
"Output": [
"23"
],
"PartialLine": 0,
"Stream": 1
}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 DQ:0 TRAP SI:0 IO

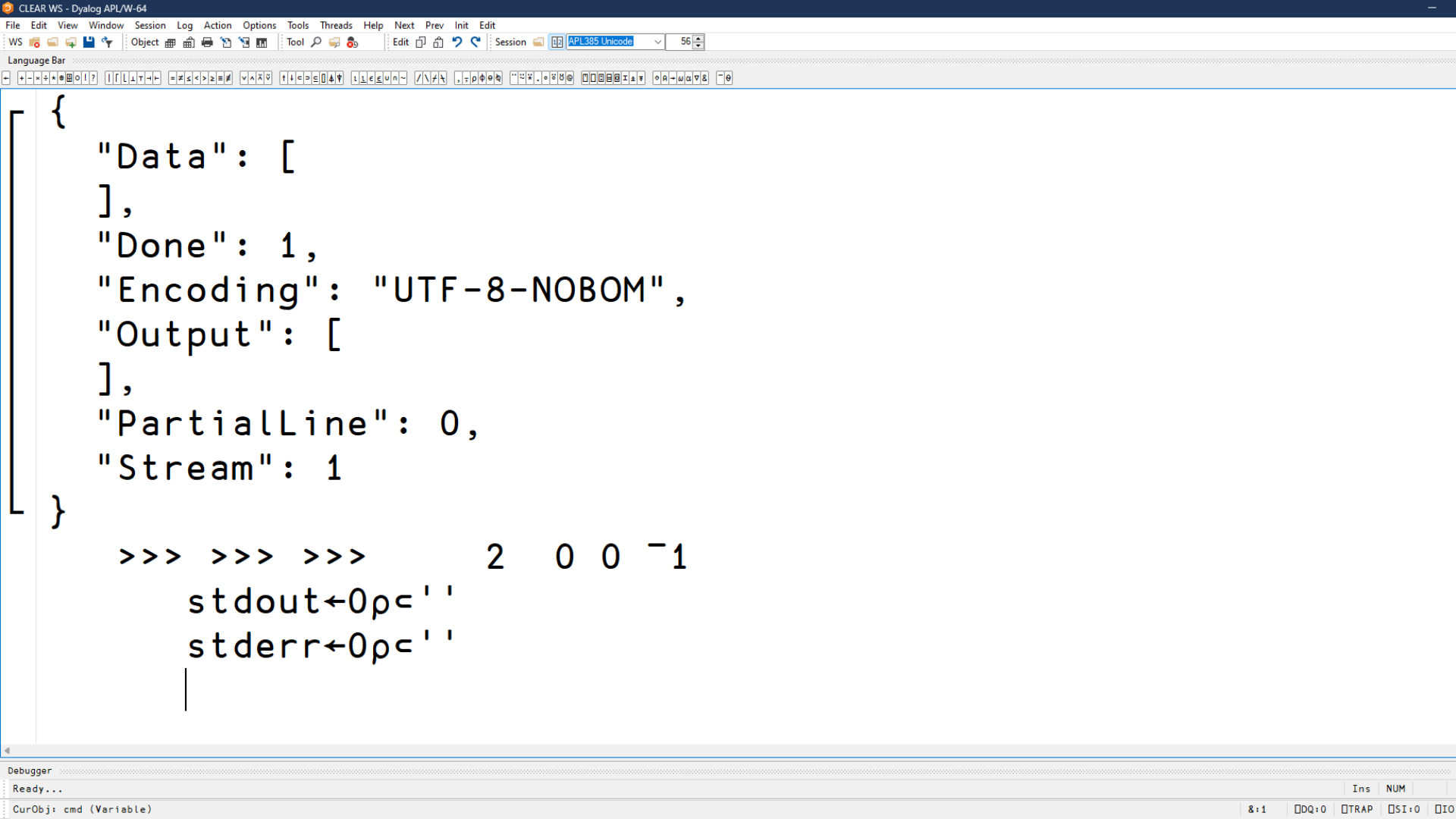

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
send 'a=5'
send 'a+18'
{
"Data": [
],
"Done": 0,
"Encoding": "UTF-8-NOBOM",
"Output": [
"23"
],
"PartialLine": 0,
"Stream": 1
}
stop 0
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 DQ:0 TRAP SI:0 IO

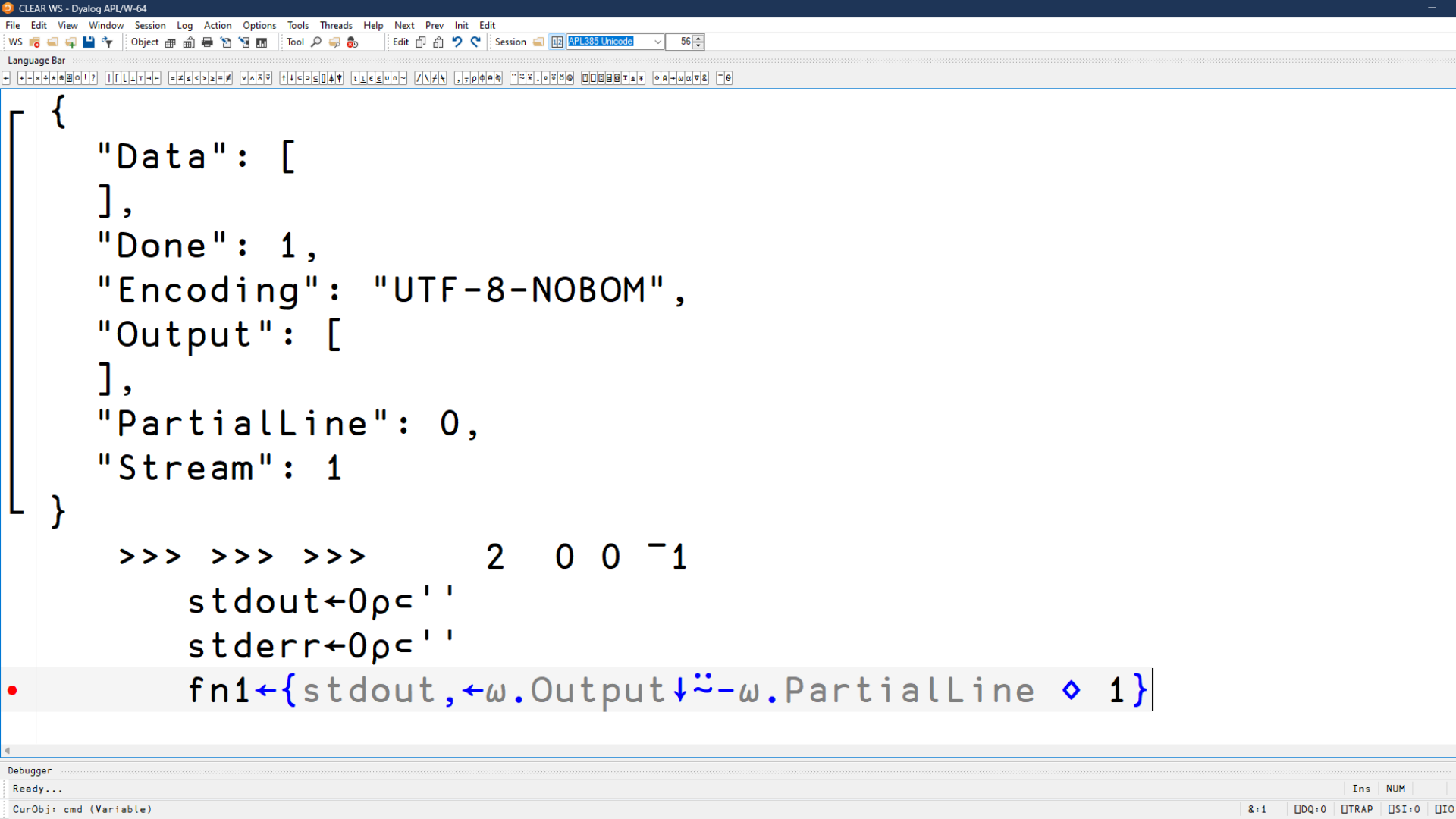

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
}
stop ⍬
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

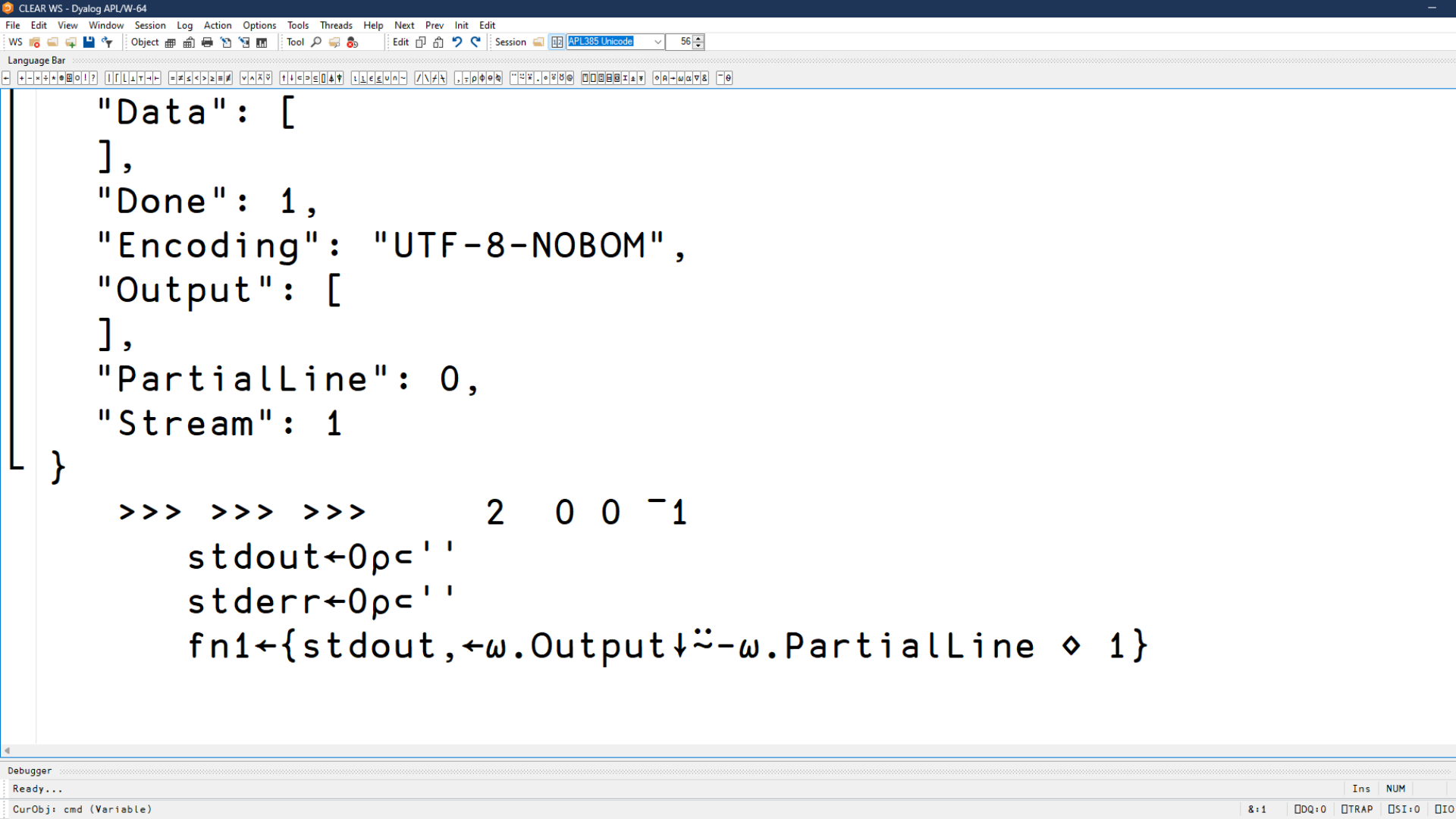

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
}
stop ⍬
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0⍴⊂''
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 DQ:0 TRAP SI:0 IO

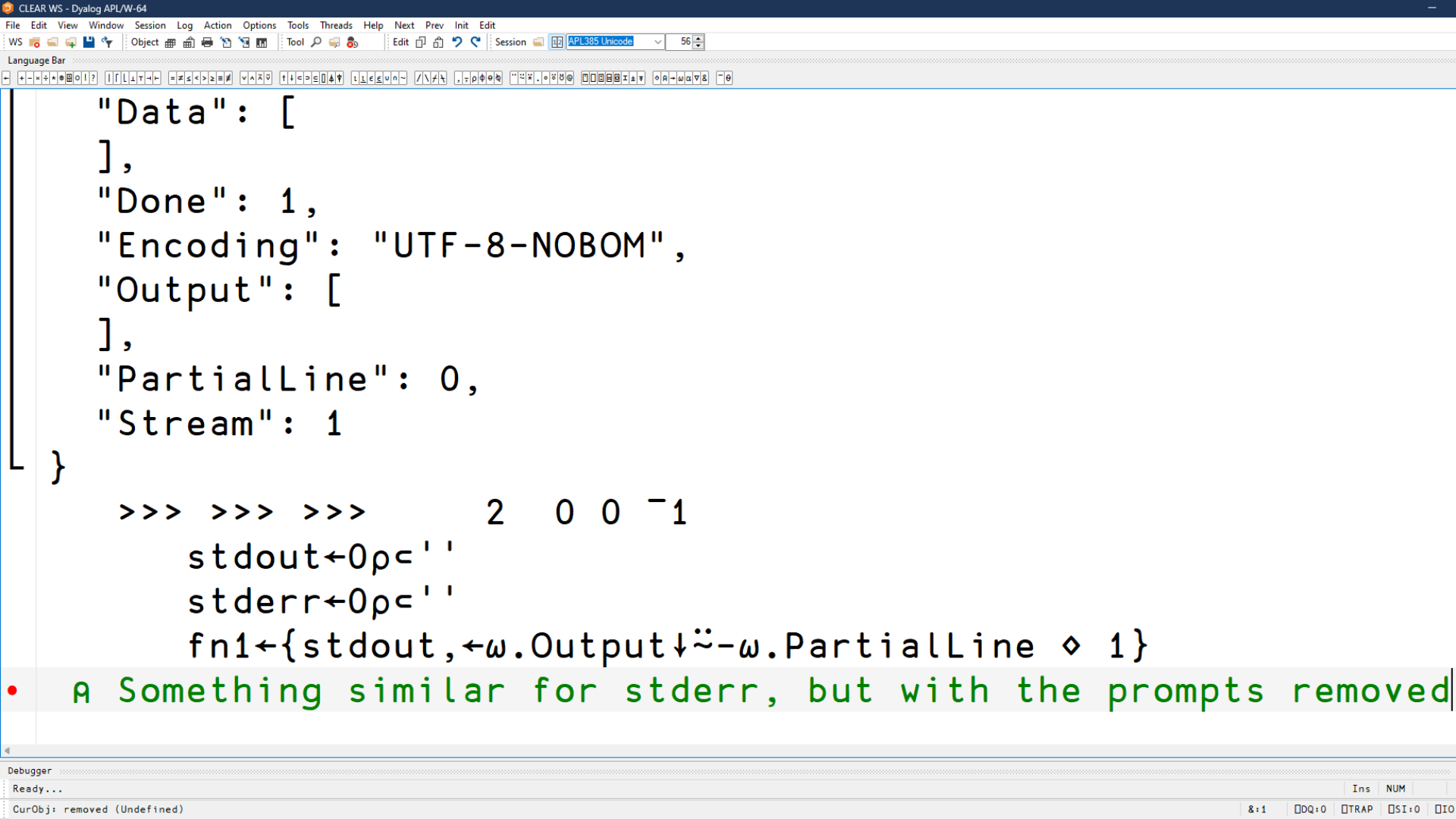

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
stop ⍬
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0⍴⊂''
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 DQ:0 TRAP SI:0 IO

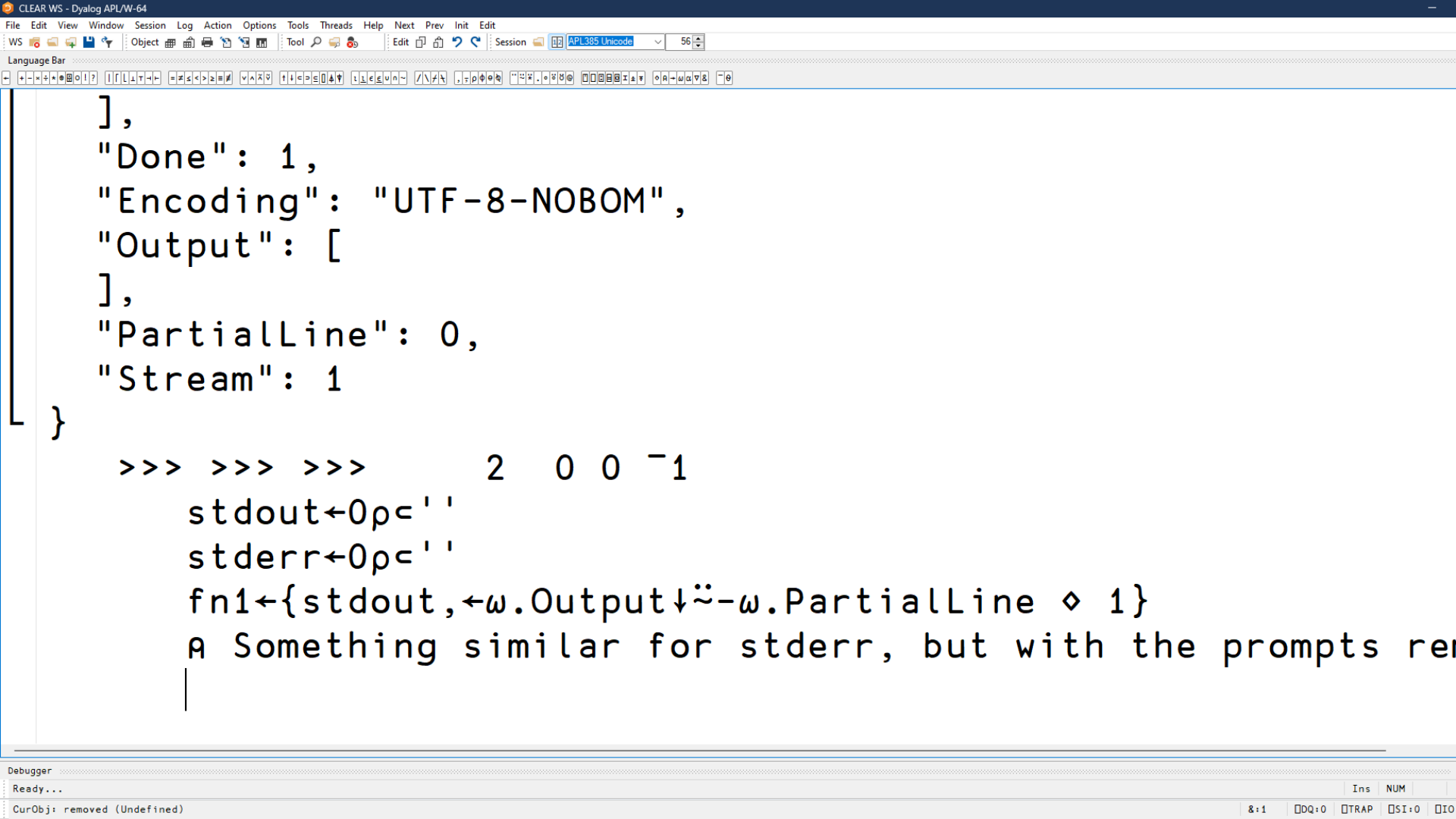

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
stop ⍬
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0⍴⊂''
stderr←0⍴⊂''
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

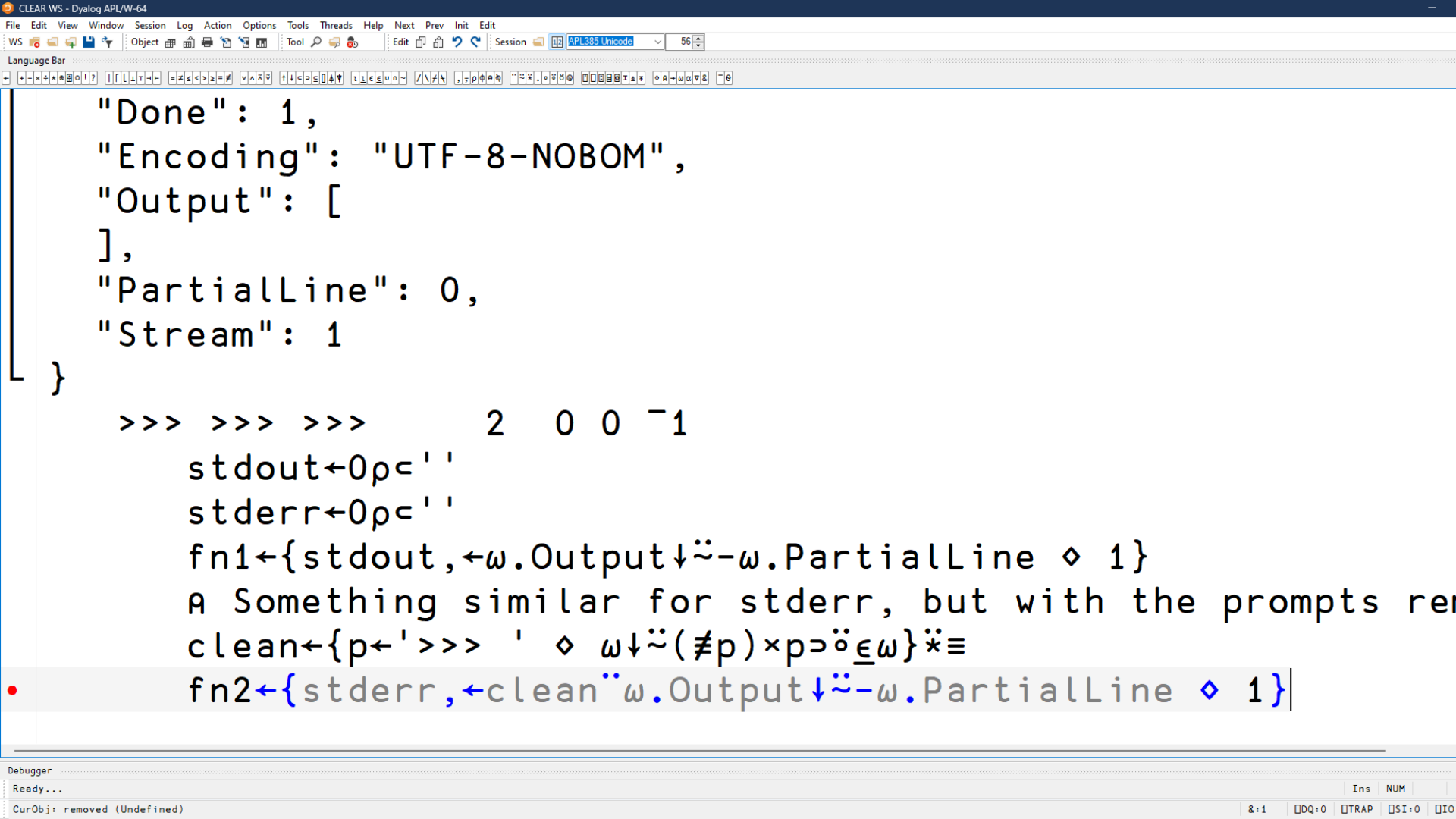

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 DQ:0 TRAP SI:0 IO

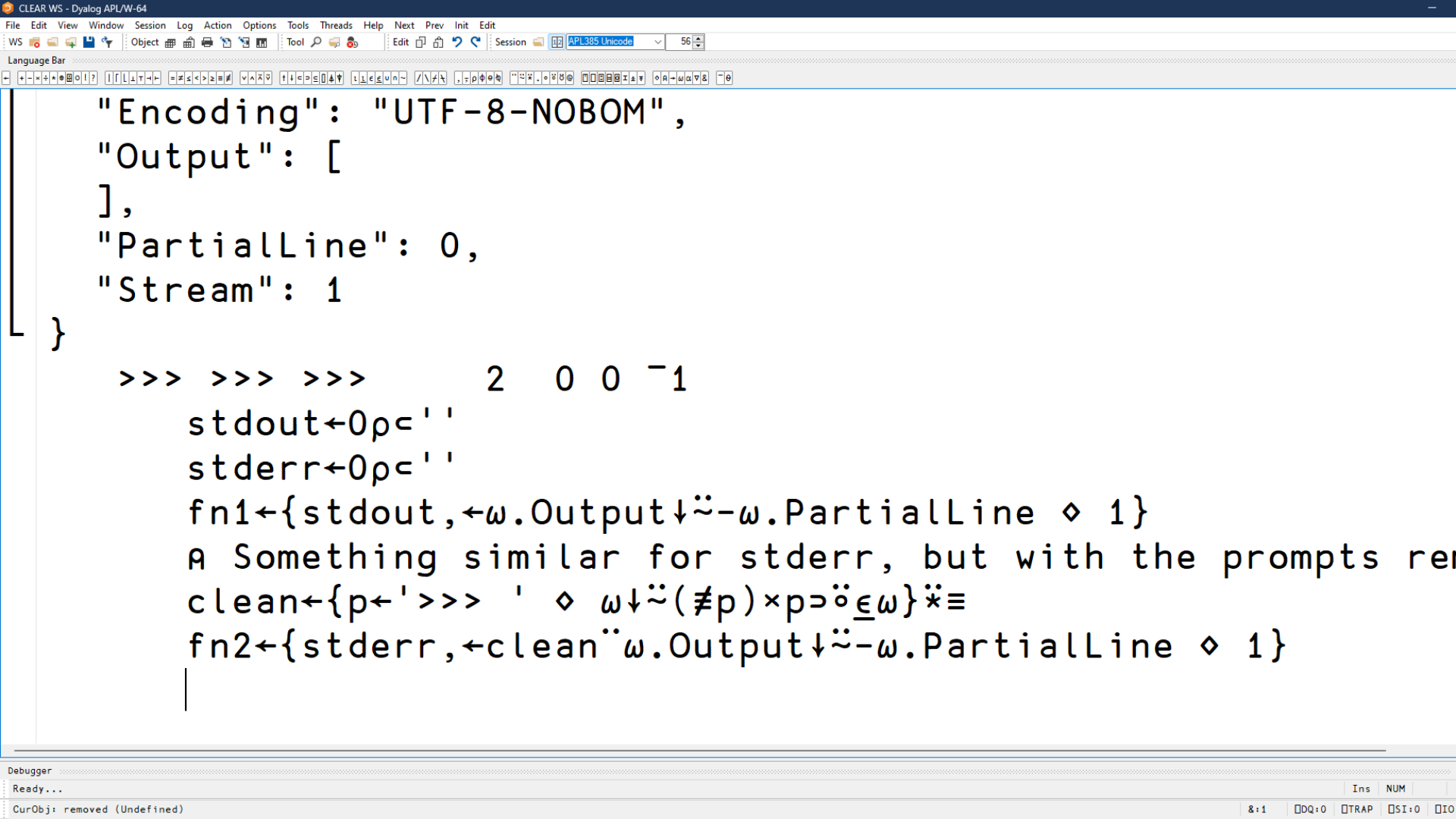

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
{
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨¯⍵.PartialLine ⋄ 1}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 DQ:0 TRAP SI:0 IO

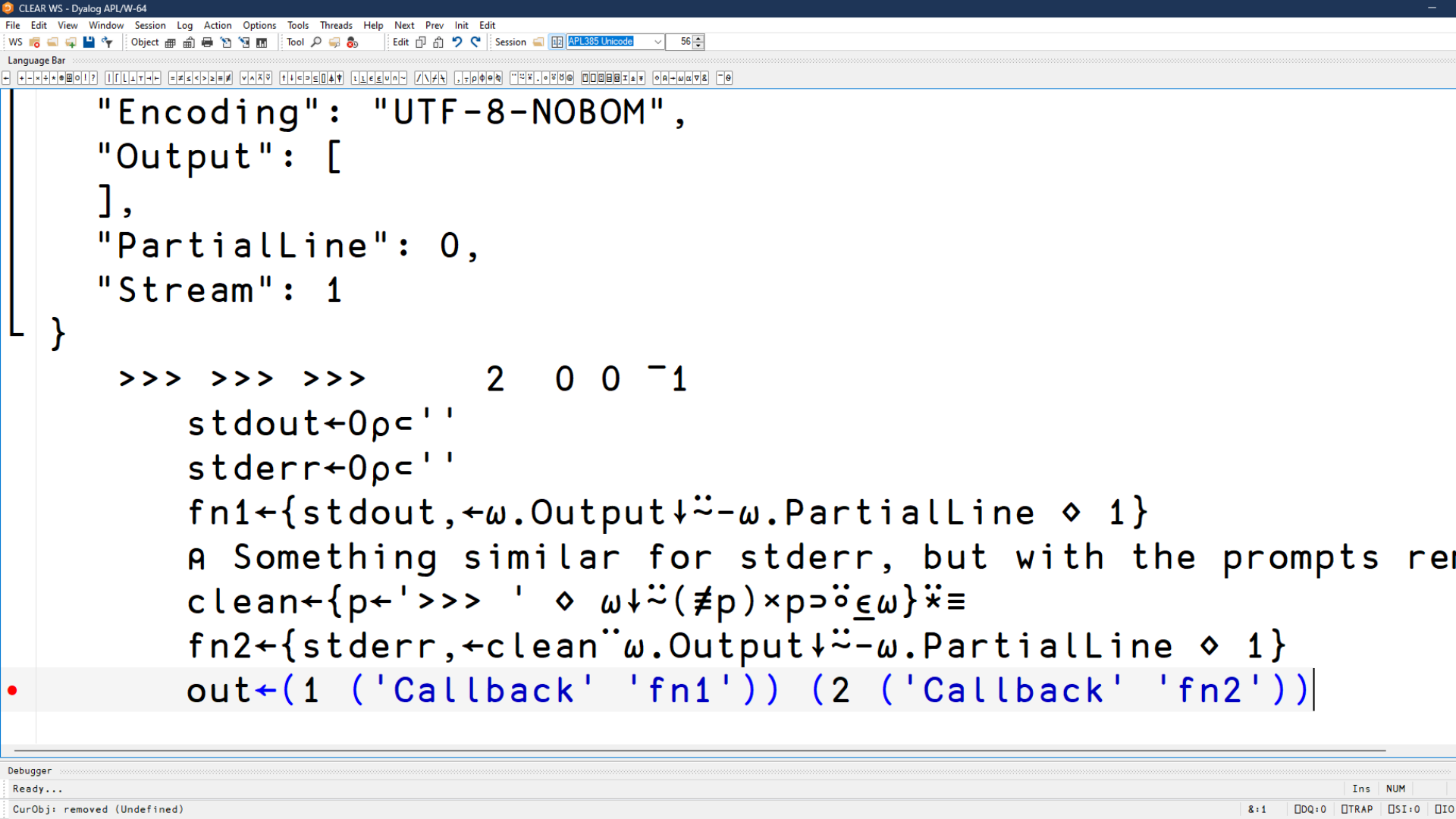

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ◇ 1}
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 DQ:0 TRAP SI:0 IO

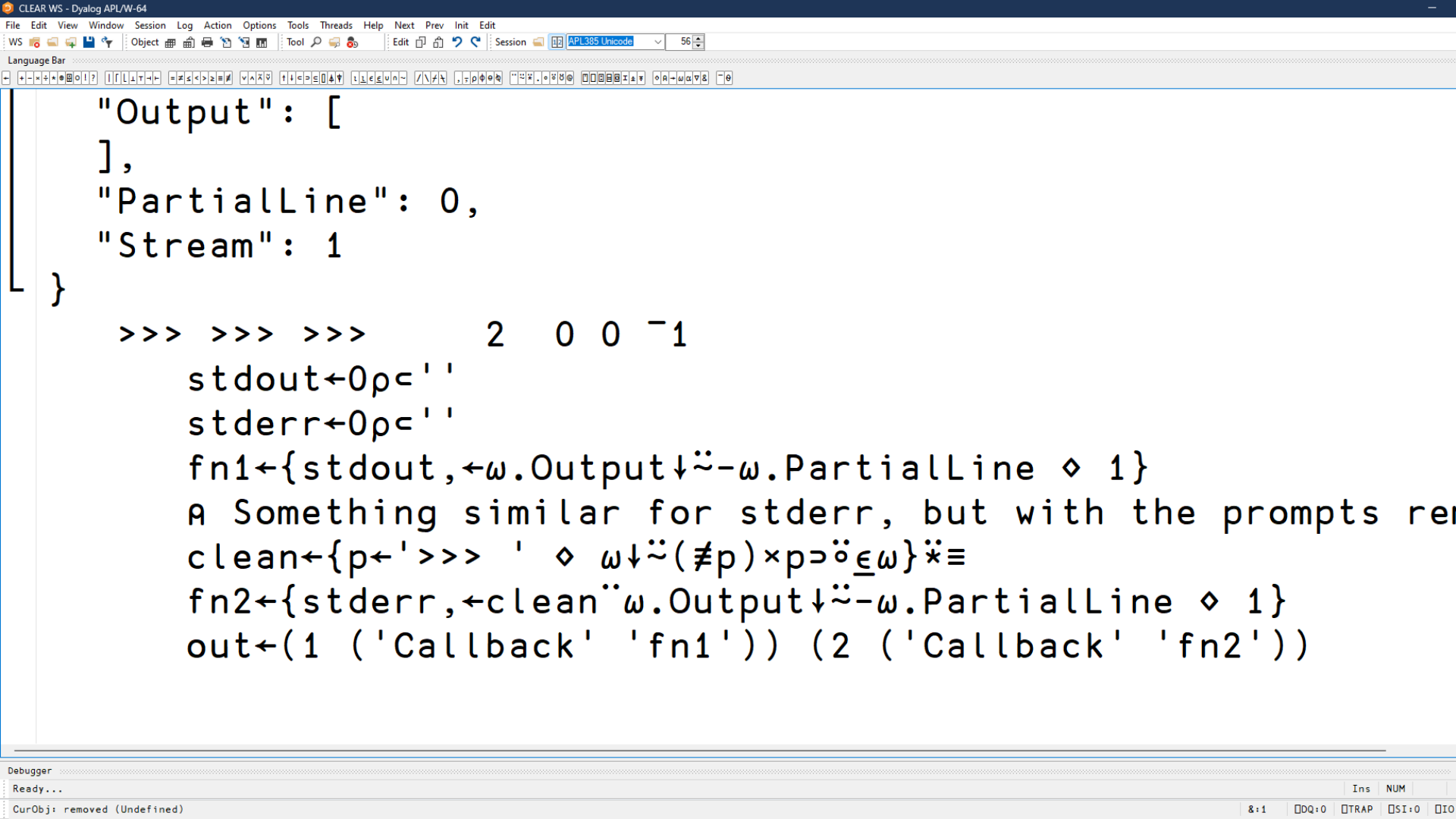

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Data": [
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ◇ 1}
⍝ Something similar for stderr, but with the prompts removed
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 DQ:0 TRAP SI:0 IO

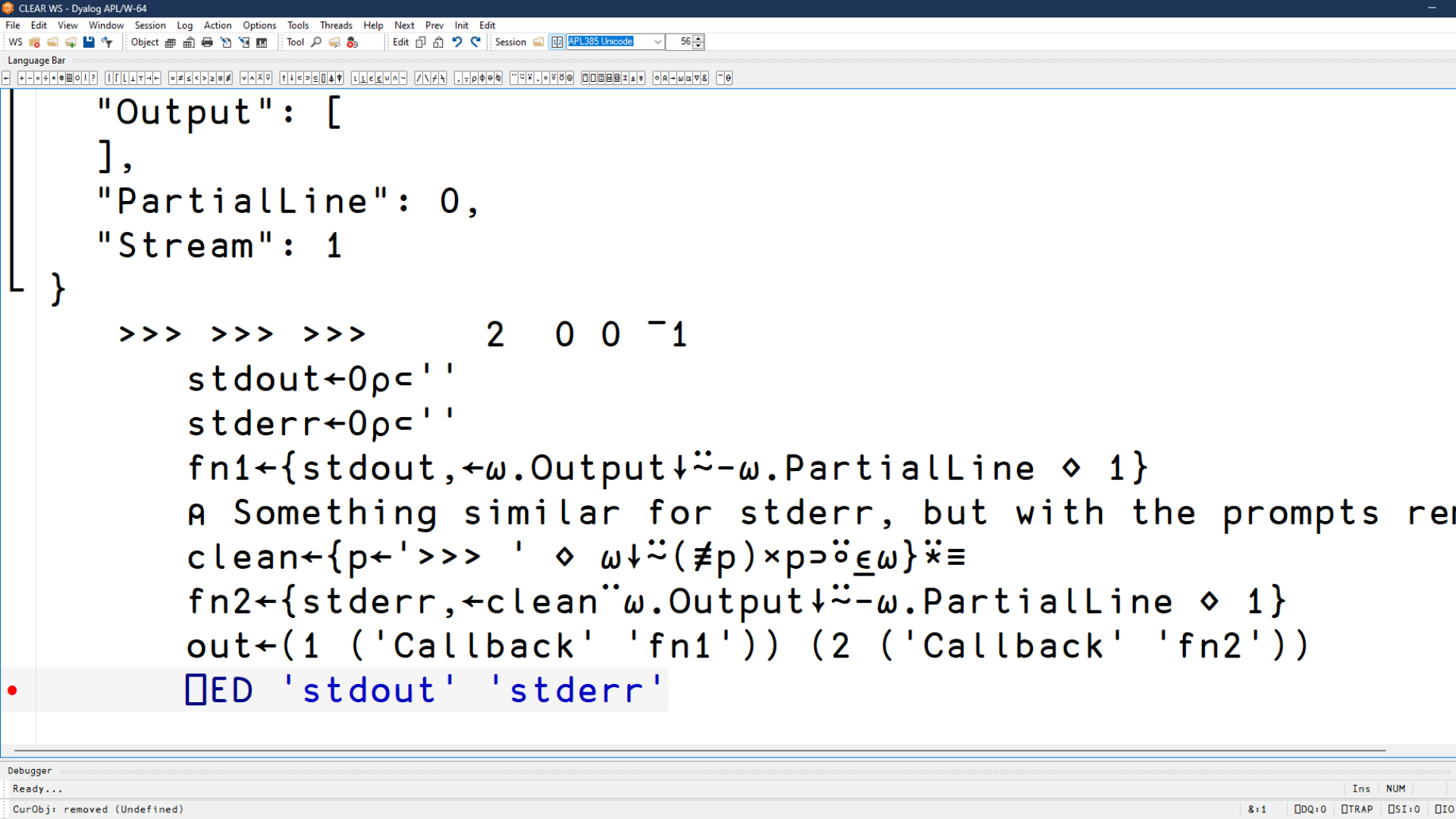

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
],
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ◇ 1}
⍝ Something similar for stderr, but with the prompts re
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 DQ:0 TRAP SI:0 IO

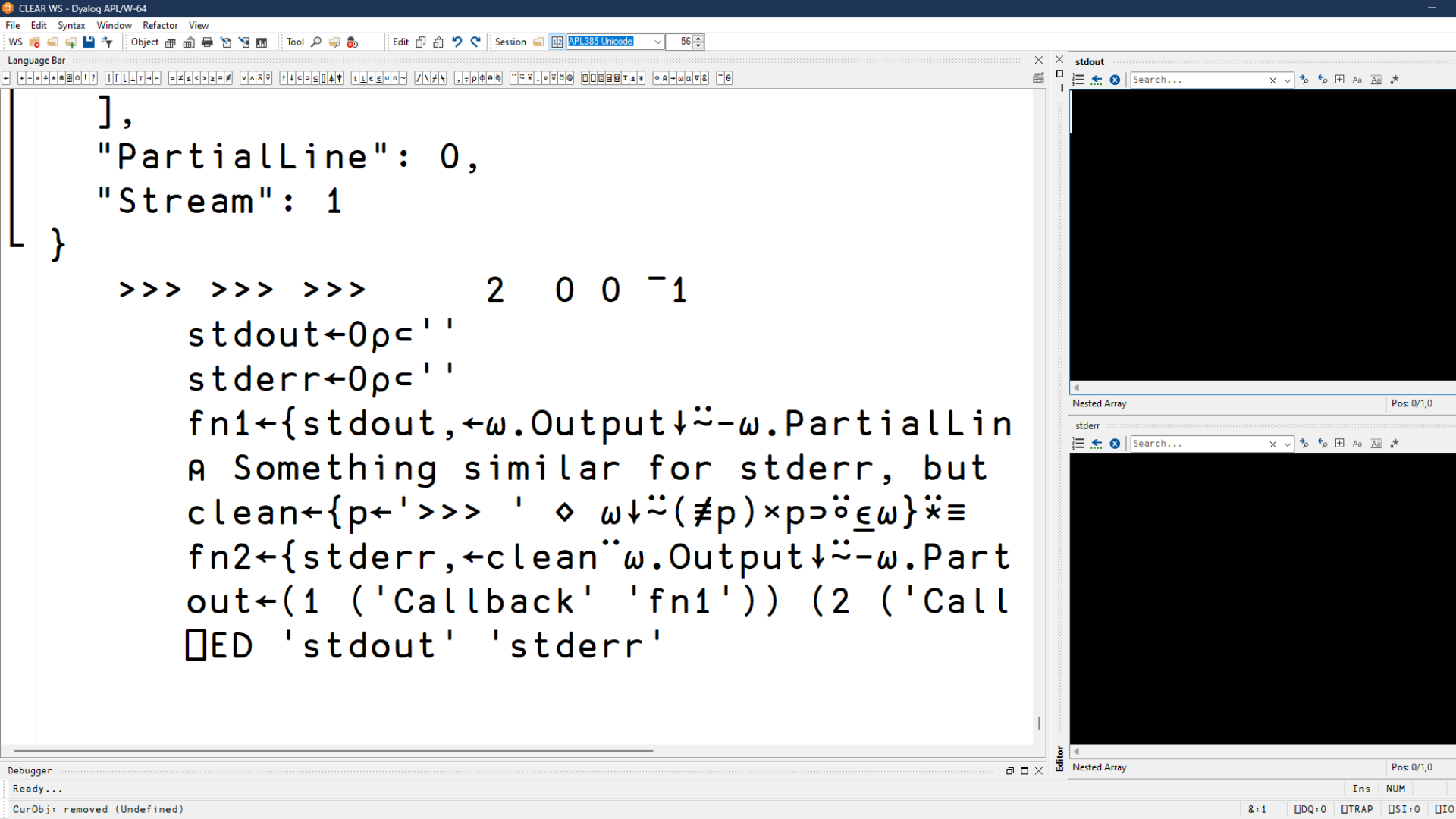

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Done": 1,
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ◇ 1}
⍝ Something similar for stderr, but with the prompts re
clean←{p←'>>> ' ◇ ⍵↓⍨(≢p)×p⊃⍤⍷⍤⊂⍵}⍤≡
fn2←{stderr,←clean¨⍵.Output↓⍨-⍵.PartialLine ◇ 1}
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
⎕IO

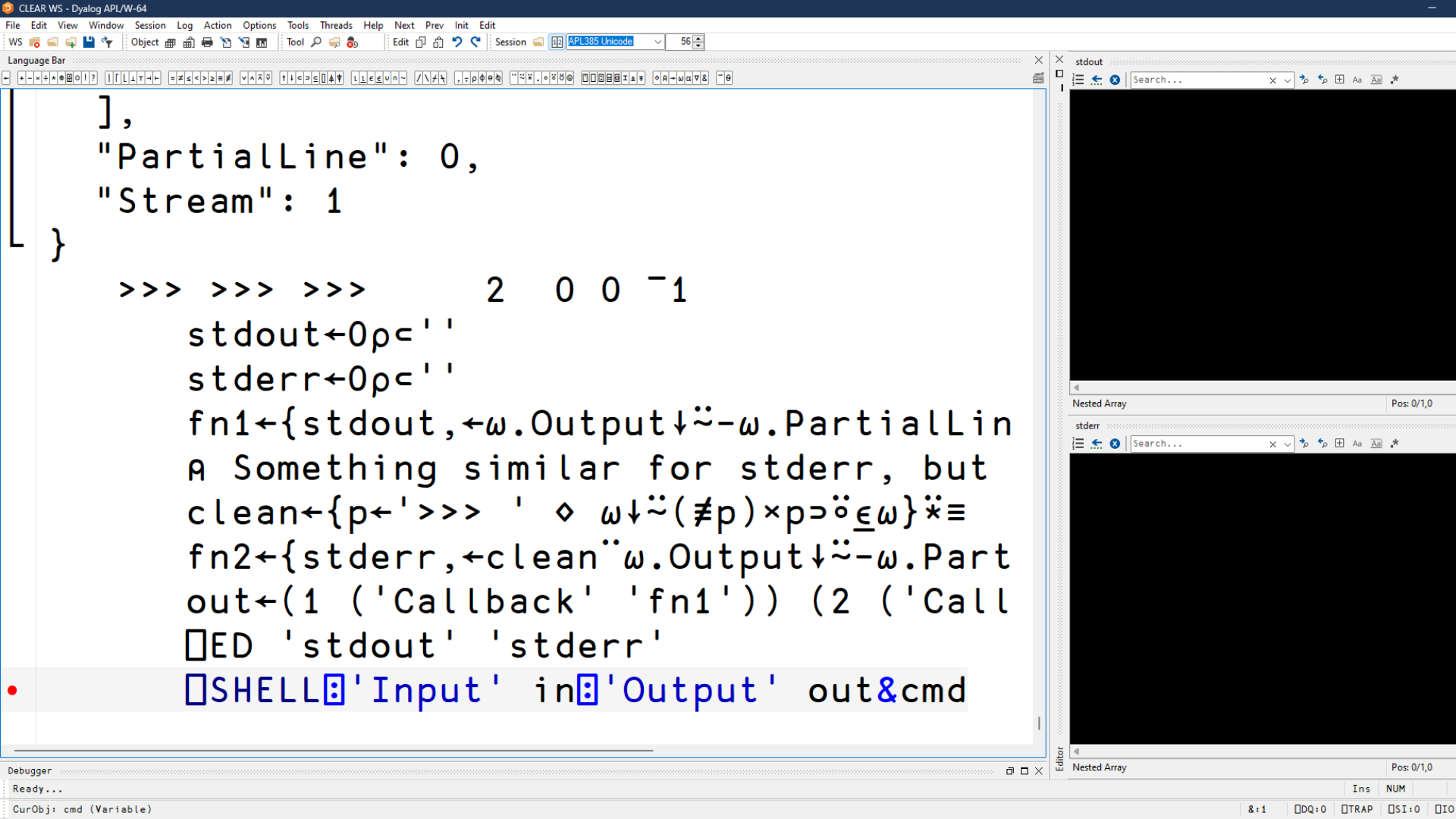

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
Language Bar
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLine ⋄ 1}
⍝ Something similar for stderr, but with the prompts re
clean←{p←'>>> ' ⋄ ω↓⍨(≢p)×p⊃⍤⍷⊂ω}⍤≡
fn2←{stderr,←clean⍤ω.Output↓⍨-ω.PartialLine ⋄ 1}
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)

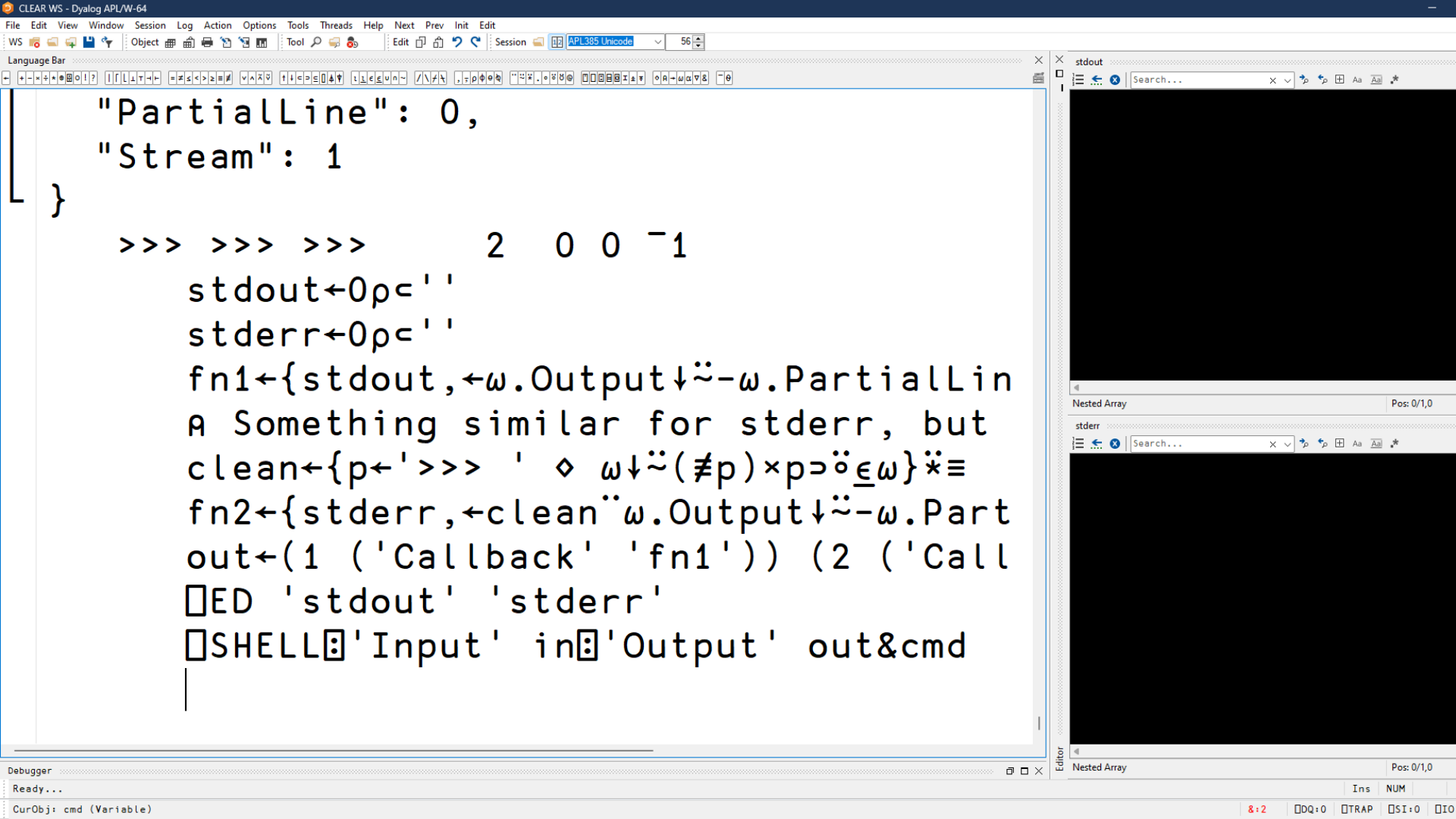

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Encoding": "UTF-8-NOBOM",
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρc''
stderr←0ρc''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLine ◇ 1}
⍝ Something similar for stderr, but with the prompts re
clean←{p←'>>> ' ◇ ω↓⍨(≢p)×p⊃⍨⍷ω}⍤≡
fn2←{stderr,←clean⍤¨ω.Output↓⍨-ω.PartialLine ◇ 1}
out←(1 ('Callback' 'fn1')) (2 ('Callback' 'fn2'))
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 DQ:0 TRAP SI:0 IO

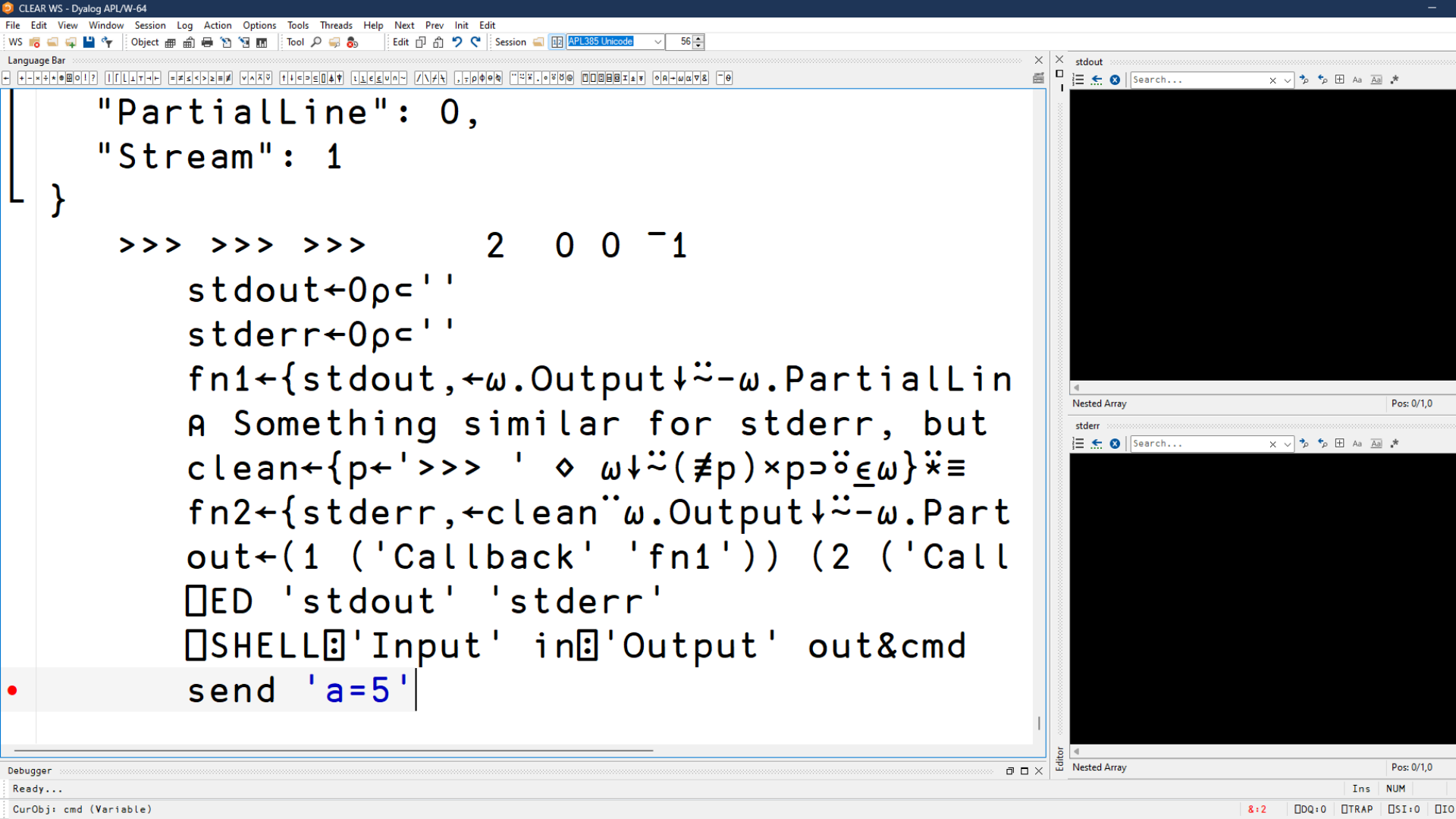

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ⋄ 1}
⍝ Something similar for stderr, but with the prompts re
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍤⍷⍤⊂⍵}⍤≡
fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.PartialLine ⋄ 1}
out←(1 ('Callback' 'fn1')) (2 ('Callback' 'fn2'))
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 DQ:0 TRAP SI:0 IO

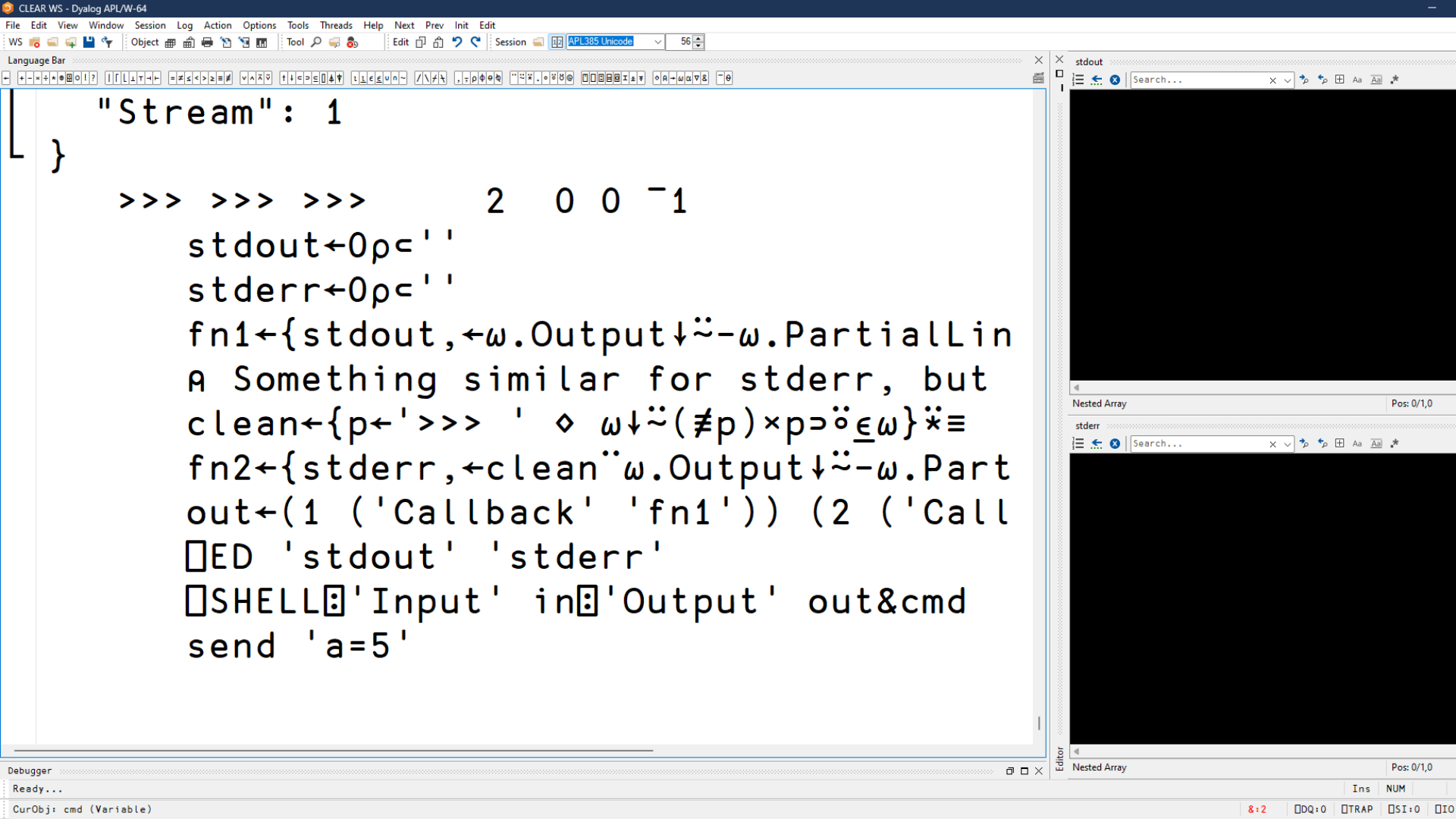

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Output": [
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLine ⋄ 1}
⍝ Something similar for stderr, but with the prompts re
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍨⍷⍵}⍤≡
fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.PartialLine ⋄ 1}
out←(1 ('Callback' 'fn1')) (2 ('Callback' 'fn2'))
⎕ED 'stdout' 'stderr'
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

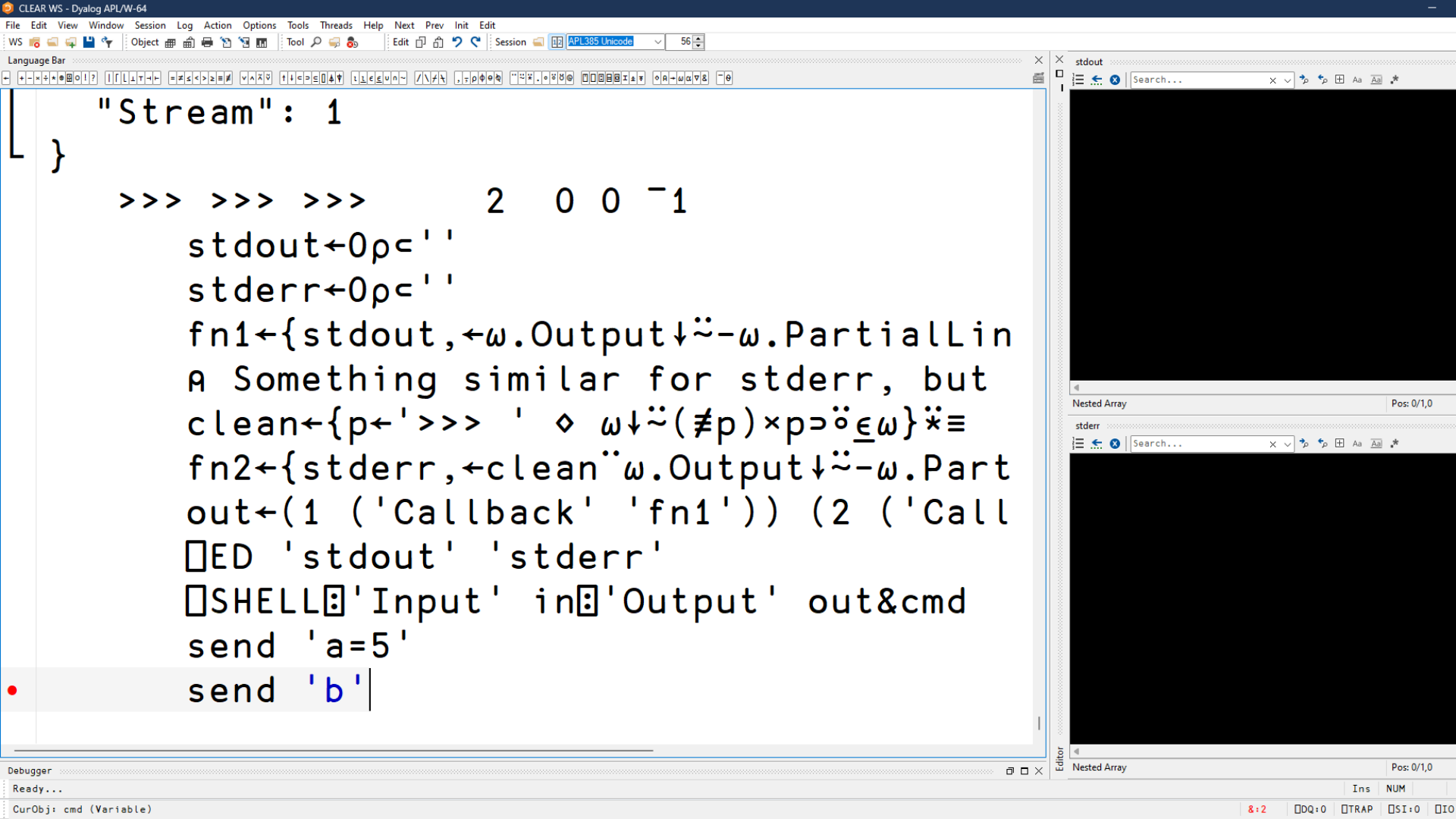

CLEAR WS - Dyalog APL/W-64
File Edit Syntax Window Refactor View
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍤⍷⍤⊂⍵}⍤≡
fn2←{stderr,←clean¨⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Editor
Debugger
Ready...
Ins NUM
CurObj: removed (Undefined)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

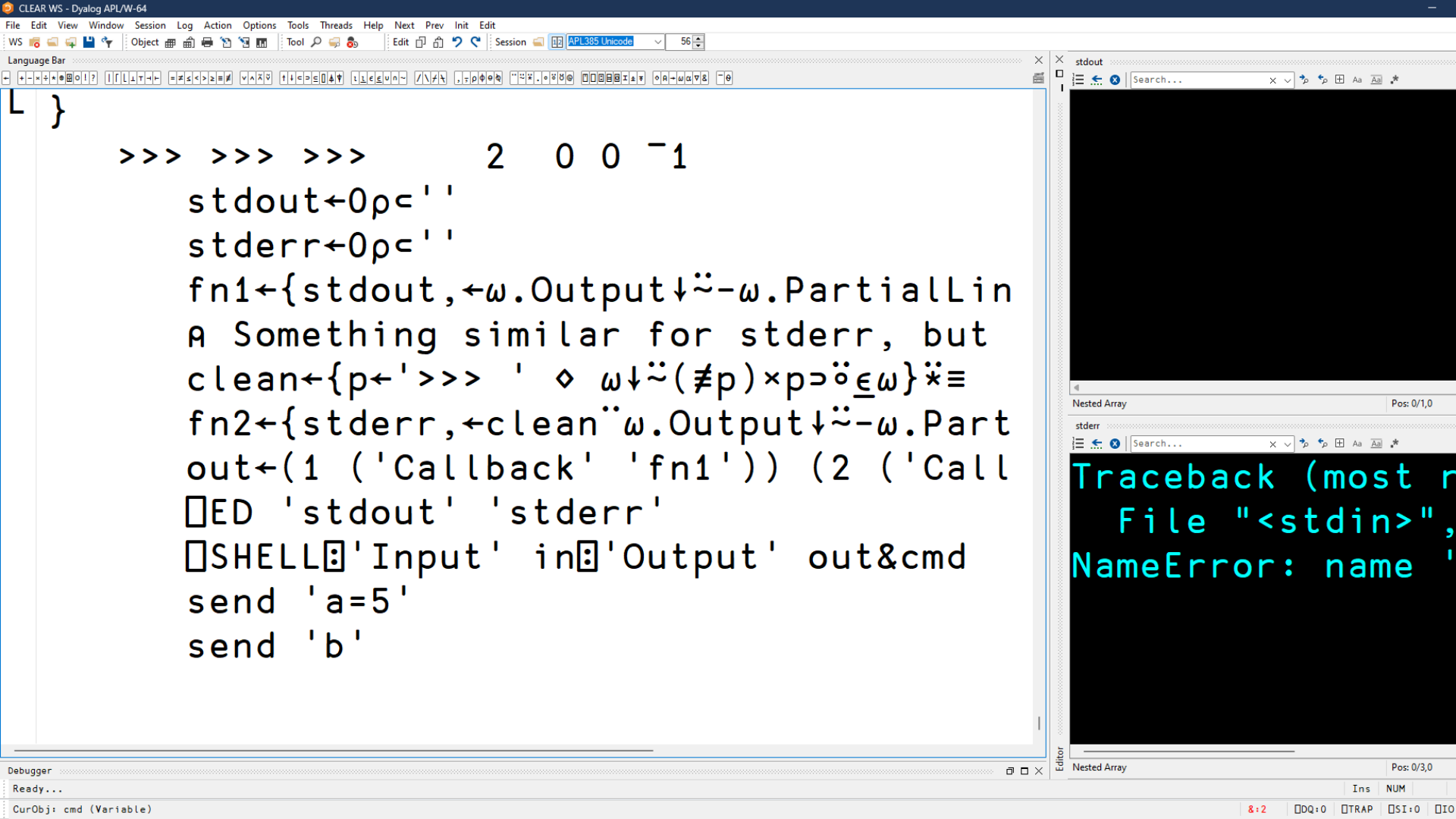

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
],
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍨⊂⍷⍵}⍤≡
fn2←{stderr,←clean¨⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

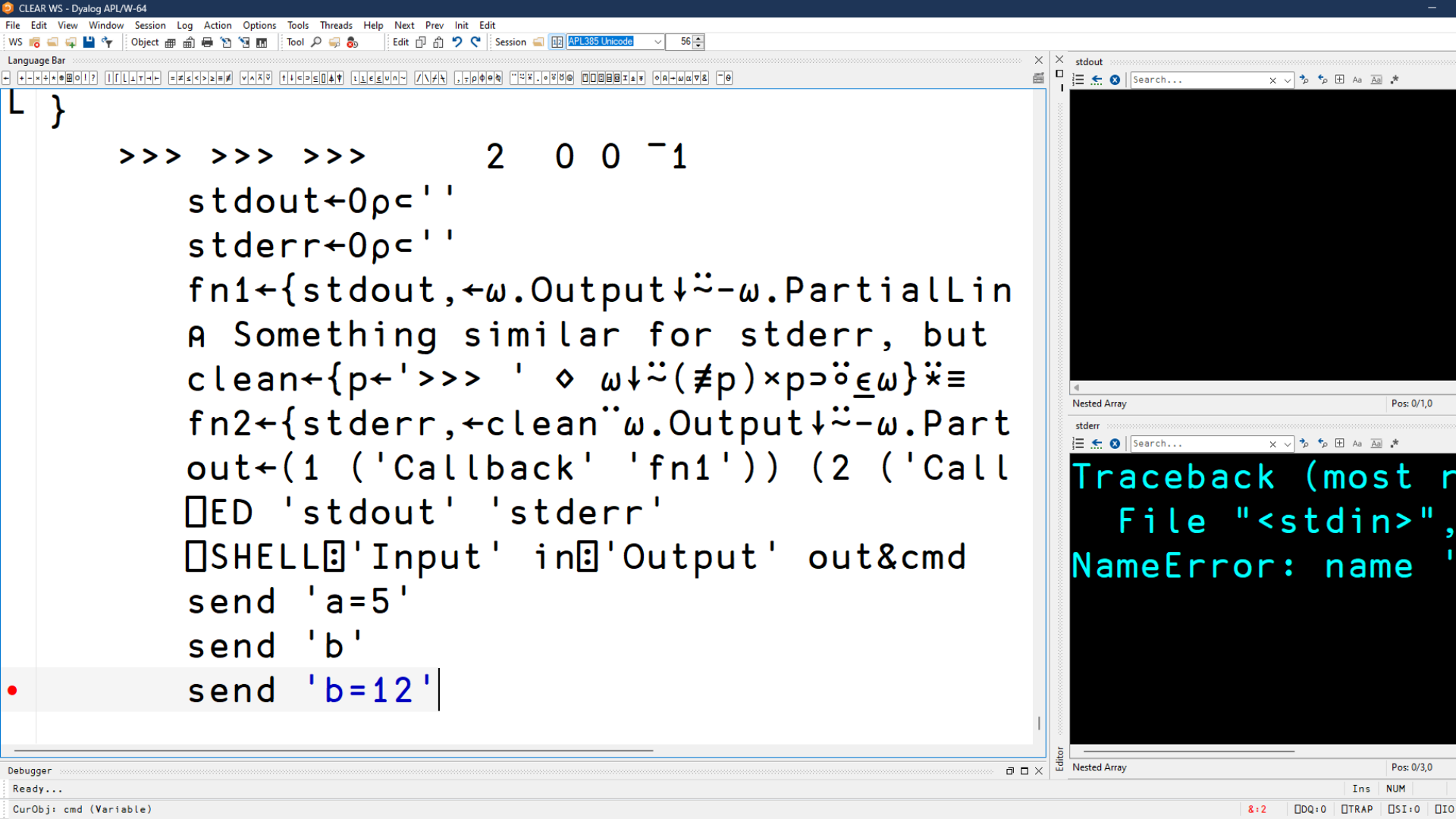

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ◇ ⍵↓⍨(≢p)×p⊃⍤⍷⍤∈⍵}⍤≡
fn2←{stderr,←clean¨⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"PartialLine": 0,
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ◇ ⍵↓⍨(≢p)×p⊃⍤⍷⍤∈⍵}⍤≡
fn2←{stderr,←clean¨⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

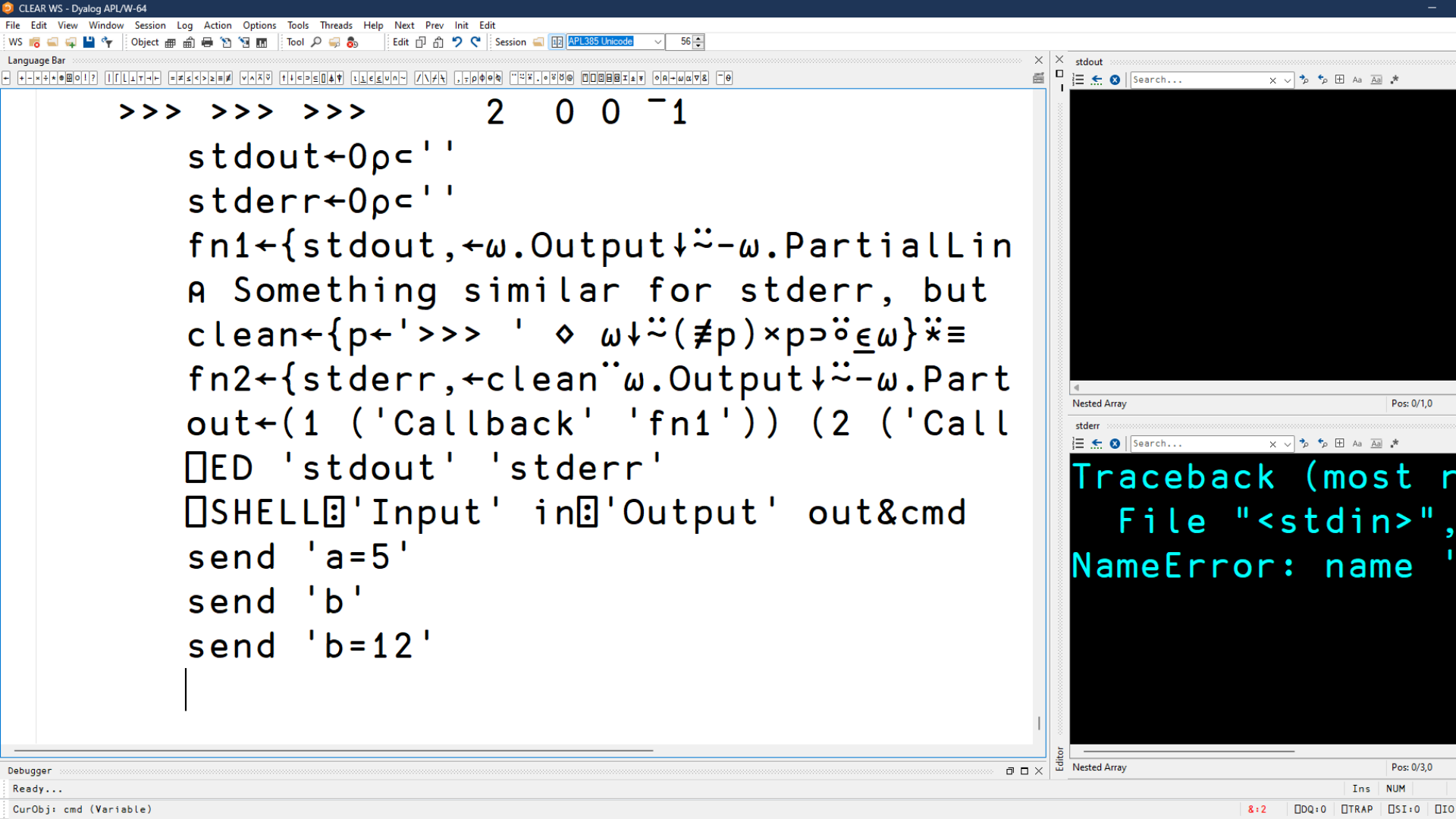

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍤⍷⍤∈⍵}⍤≡
fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

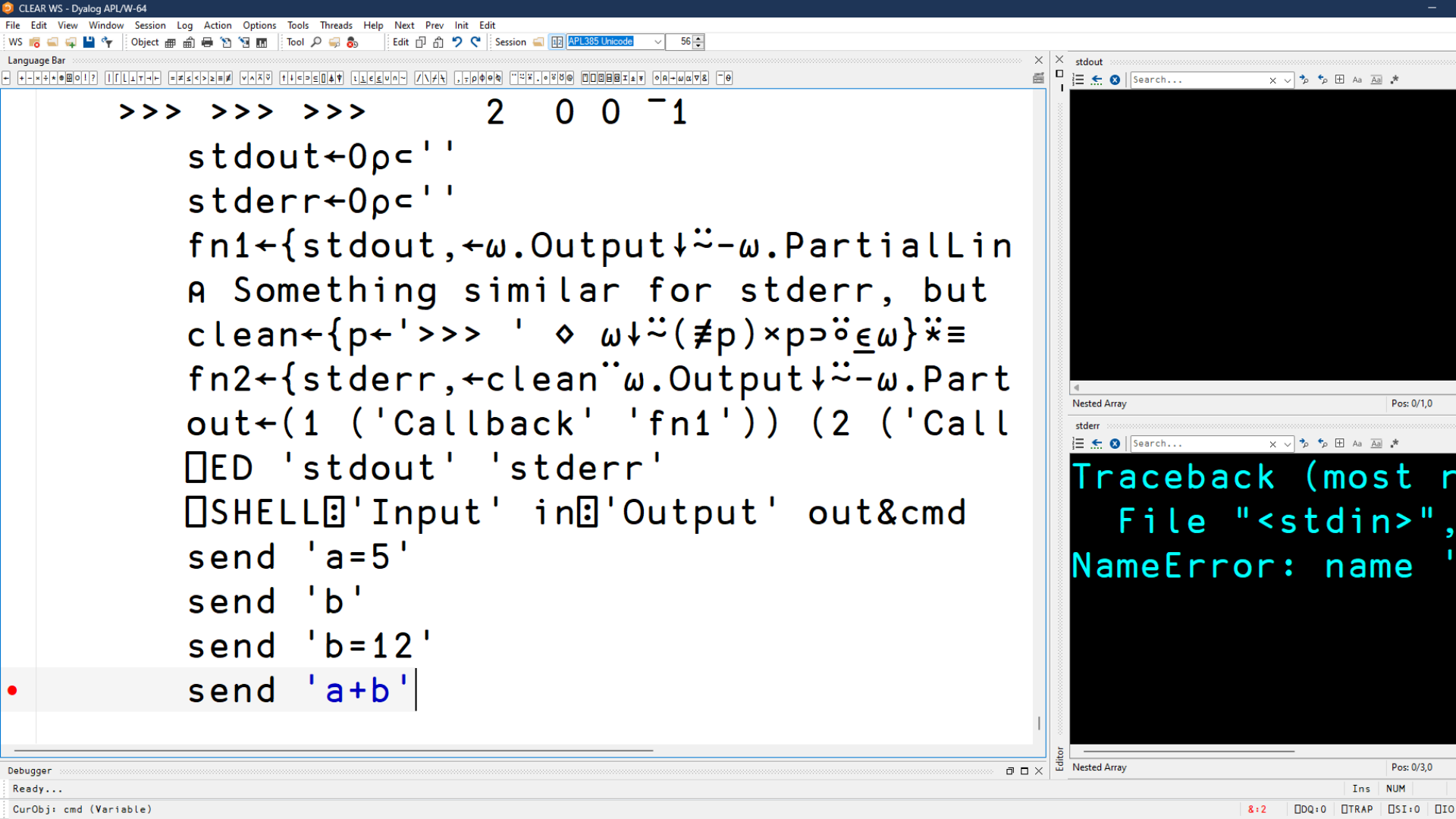

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
"Stream": 1
}
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍤⍷⊂⍵}⍤≡
fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
Debugger
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Nested Array
Pos: 0/1,0
Editor
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

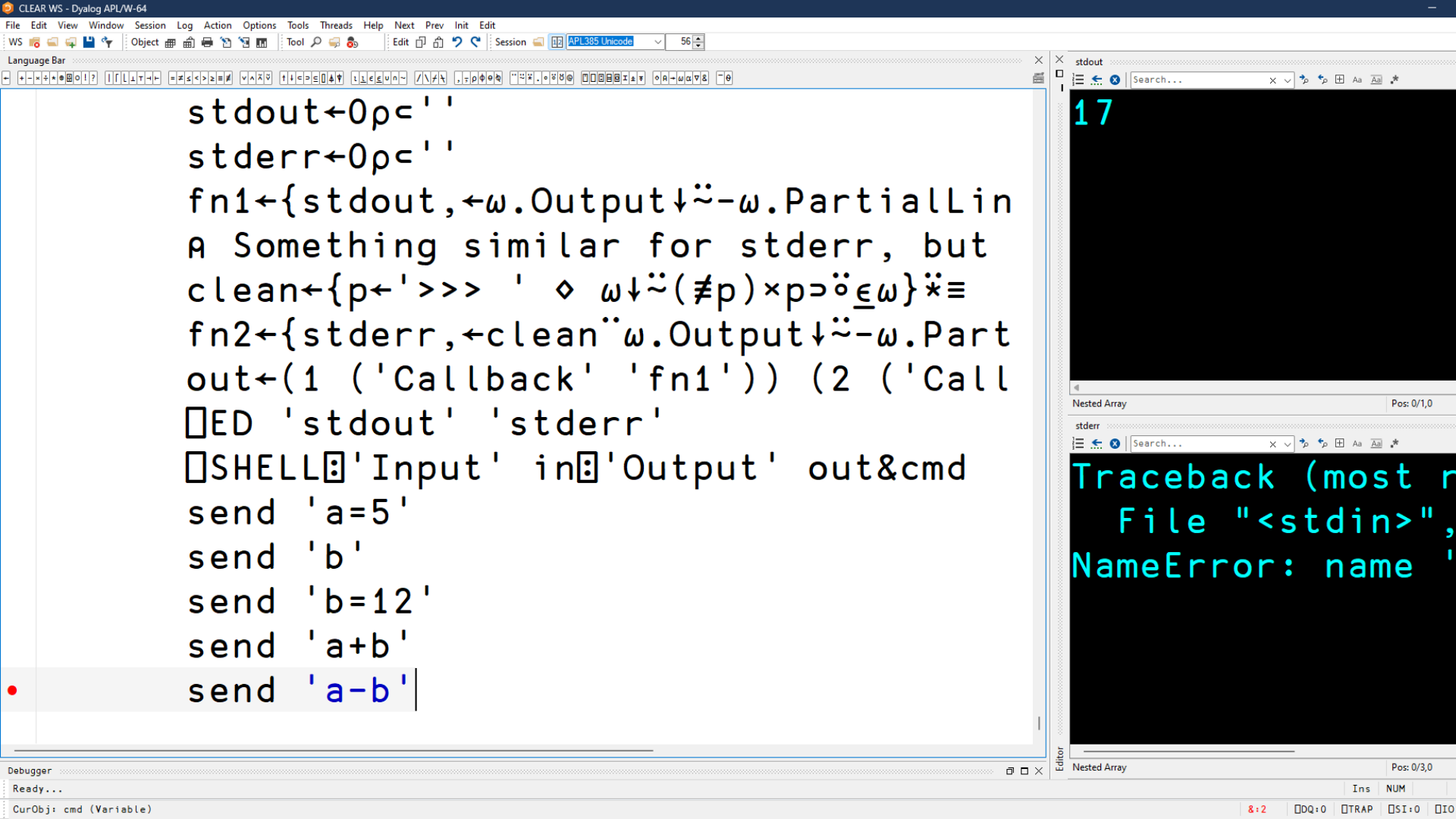

CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
} >>> >>> >>> 2 0 0 ¯1
stdout←0ρc''
stderr←0ρc''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ω↓⍨(≢p)×p⊃⍤⍷⊂ω}⍤≡
fn2←{stderr,←clean⍨ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
⍝:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

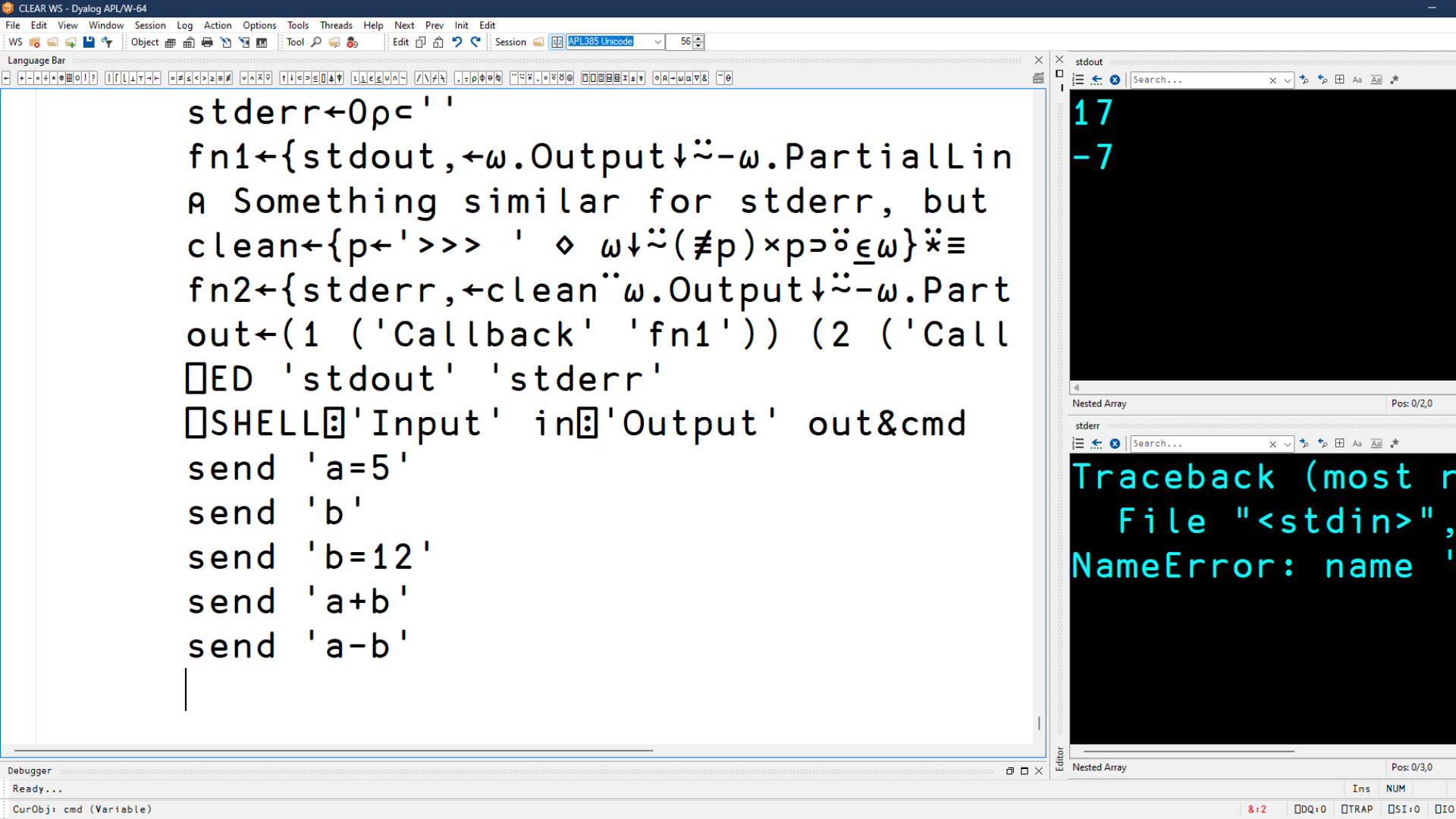


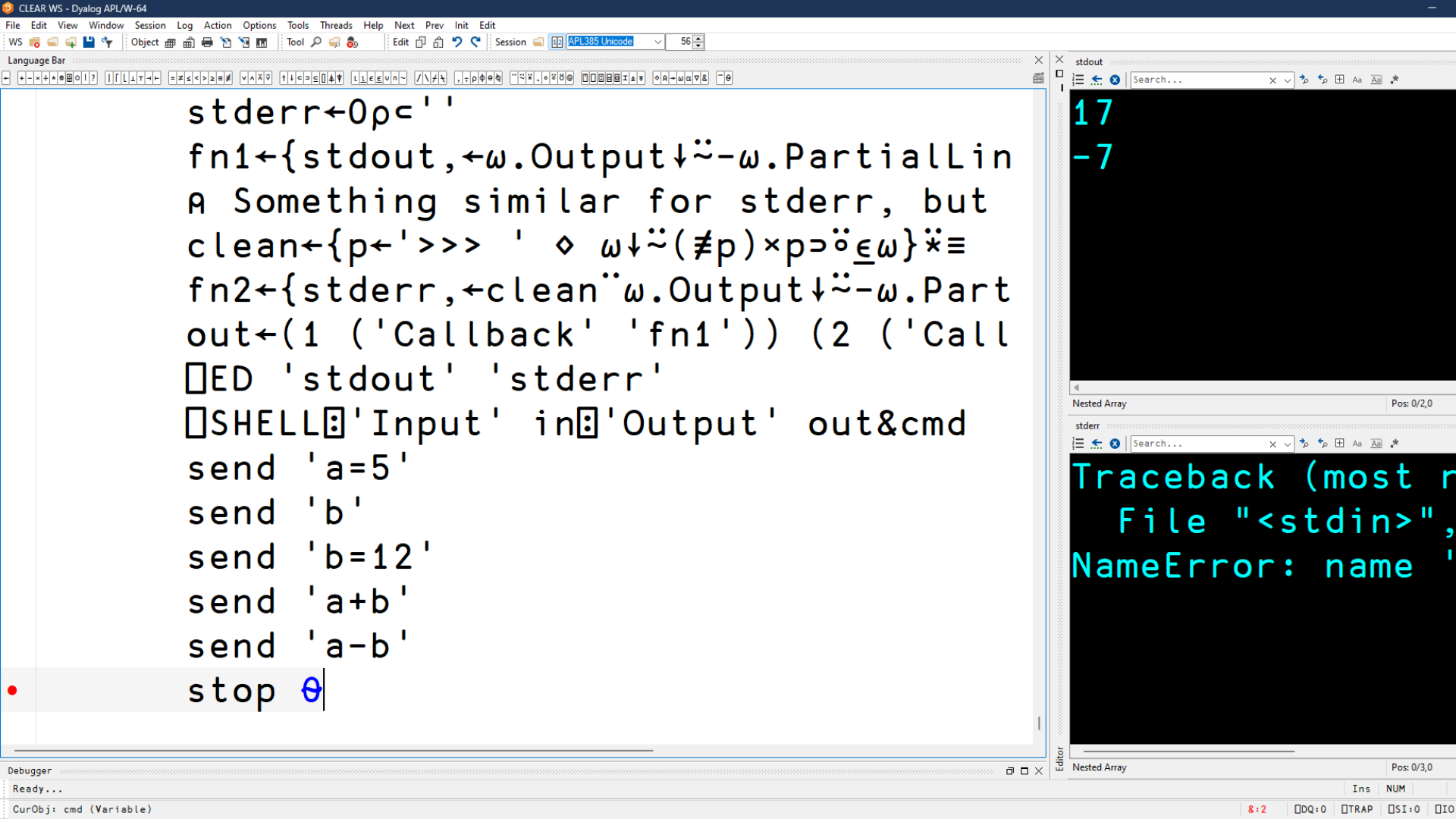

```
L }
      >>> >>> >>>      2  0 0 ¯1
          stdout←0ρ⊂''
          stderr←0ρ⊂''
          fn1←{stdout,←⍵.Output↓⍨-⍵.PartialLin
          ⍝ Something similar for stderr, but
          clean←{p←'>>> ' ⋄ ⍵↓⍨(≢p)×p⊃⍤⍷⊂⍵}⍤≡
          fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.Part
          out←(1 ('Callback' 'fn1')) (2 ('Call
          ⎕ED 'stdout' 'stderr'
          ⎕SHELL⍠'Input' in⍠'Output' out&cmd
          send 'a=5'
          send 'b'
          send 'b=12'
```


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ⋄ ω↓⍨(≢p)×p⊃⍸⍷ω}⍤≡
fn2←{stderr,←clean⍨ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
>>> >>> >>> 2 0 0 ¯1
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ◇ ω↓⍨(≢p)×p⊃⍸⍷ω}⌸≡
fn2←{stderr,←clean¨ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
send 'a+b'
stdout
Search...
Nested Array
Pos: 0/1,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
stdout←0ρ⊂''
stderr←0ρ⊂''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ◇ ω↓⍨(≢p)×p⊃⍤⍷⊂ω}⍤≡
fn2←{stderr,←clean⍤ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
send 'a+b'
send 'a-b'
stdout
Search...
17
Nested Array
Pos: 0/1,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
stderr←0ρ⊂''
fn1←{stdout,←ω.Output↓⍨-ω.PartialLin
⍝ Something similar for stderr, but
clean←{p←'>>> ' ◇ ω↓⍨(≠p)×p⊃⍷⍷ω}⍤≡
fn2←{stderr,←clean⍨ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
send 'a+b'
send 'a-b'
stdout
Search...
17
-7
Nested Array
Pos: 0/2,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
⍝:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
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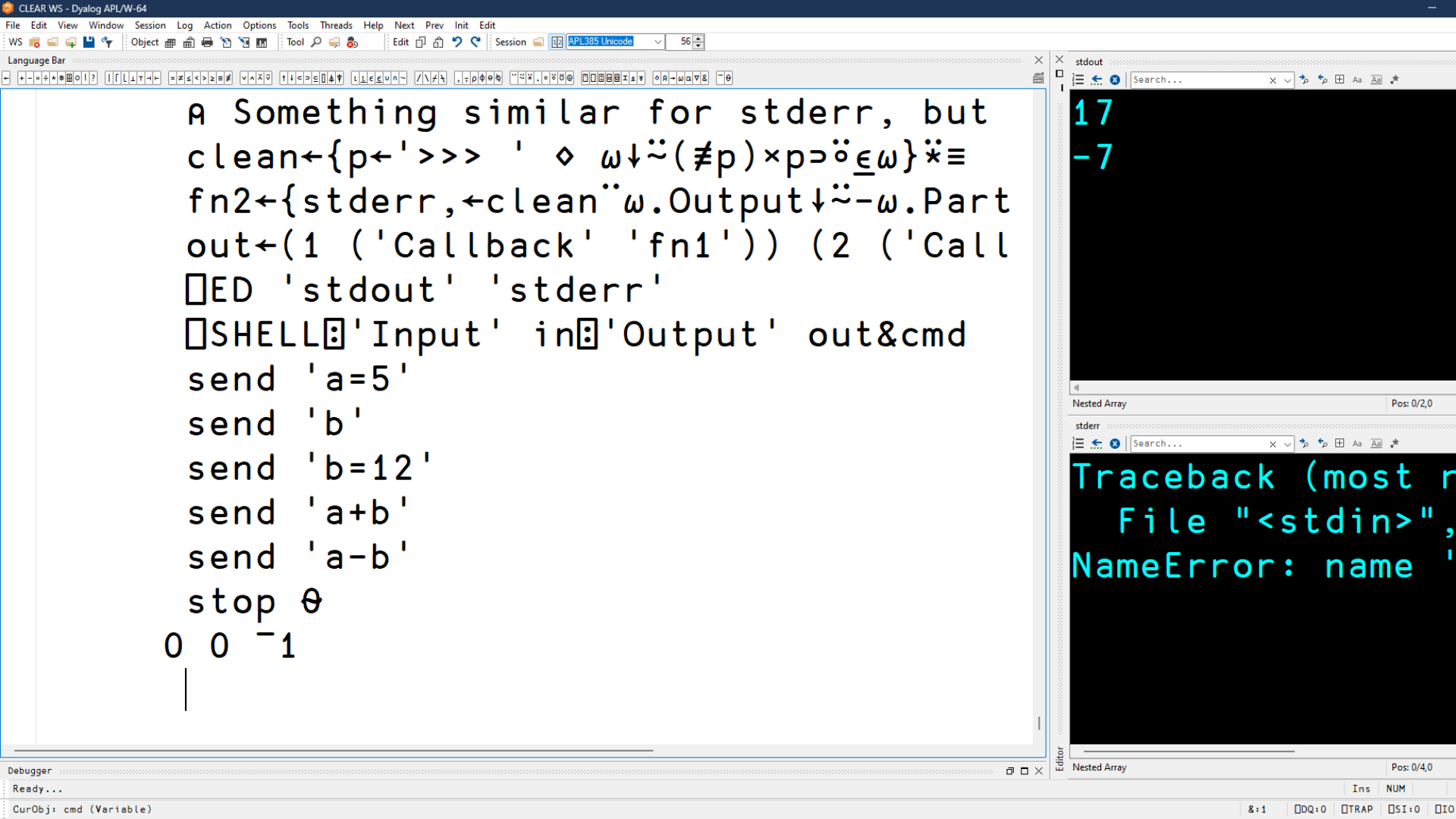
fn2←{stderr,←clean⍨ω.Output↓⍨-ω.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
send 'a+b'
send 'a-b'
stop 0
stdout
17
-7
Nested Array
Pos: 0/2,0
stderr
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/3,0
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:2 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO


CLEAR WS - Dyalog APL/W-64
File Edit View Window Session Log Action Options Tools Threads Help Next Prev Init Edit
WS Object Tool Edit Session APL385 Unicode 56
Language Bar
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fn2←{stderr,←clean⍤⍵.Output↓⍨-⍵.Part
out←(1 ('Callback' 'fn1')) (2 ('Call
⎕ED 'stdout' 'stderr'
⎕SHELL⍠'Input' in⍠'Output' out&cmd
send 'a=5'
send 'b'
send 'b=12'
send 'a+b'
send 'a-b'
stop 0
0 0 ¯1
stdout
Search...
17
-7
Nested Array
Pos: 0/2,0
stderr
Search...
Traceback (most r
File "<stdin>",
NameError: name '
Nested Array
Pos: 0/4,0
Editor
Debugger
Ready...
Ins NUM
CurObj: cmd (Variable)
&:1 ⎕DQ:0 ⎕TRAP ⎕SI:0 ⎕IO

Demo

- This is of course only an example
- Wrap it up in a class
  - `p←⎕NEW python`
  - …

Summary

- New system function in version 20
- We think the design is complete
  - Come see me if you disagree