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; Final Project: Character Frequency Counter

.ORIG x3000

; Prompt user for input

LEA R0, USER\_PROMPT

PUTS

; Initialize index to 0

AND R2, R2, #0 ;Clear R2 and set it to zero

STI R2, INDEX

; Input loop

INPUT\_STR

GETC ;Reads in char, store to R0

OUT

JSR STORE\_INPUT ;Jump to Store Input subroutine

ADD R1, R0, #-10 ;Check for ENTER (newline)

BRz EXIT ;Branch if Enter is pressed

BR INPUT\_STR ;Loop input string if Enter is not pressed

;Exit initial loop

EXIT

JSR GET\_LENGTH ;Jump to subroutines

JSR COUNT\_FREQ

JSR PRINT\_FREQ

LEA R0, ENDMSG ;Load address of ENDMSG

PUTS ;Output ENDMSG

HALT

; -----------------------------

; Subroutine: STORE\_INPUT

; Stores character from R0 into STR\_ARR[i]

STORE\_INPUT

LDI R1, STR\_PTR ; R1 = base address of STR\_ARR

LDI R2, INDEX ; R2 = current index i

;Check for error (input >= 30)

LD R3, NEG\_30 ;Loading -30 into R3, check if str input >= 30

ADD R4, R2, R3 ; R4 = i - 30

BRzp ERR ; if i >= 30, branch to error

ADD R5, R1, R2

STR R0, R5, #0 ; store input character

ADD R2, R2, #1 ; i++

STI R2, INDEX ;Store updated i in INDEX

RET

; -----------------------------

; Subroutine: GET\_LENGTH

; Saves final length into STR\_LEN

GET\_LENGTH

LDI R1, INDEX

STI R1, STR\_LEN ;Store string length in R1

RET

; -----------------------------

; Subroutine: COUNT\_FREQ

; Loops through STR\_ARR and counts uppercase letter frequencies

COUNT\_FREQ

LDI R1, STR\_PTR ; R1 = STR\_ARR base

AND R2, R2, #0

LDI R3, STR\_LEN ; R3 = string length

CF\_LOOP\_START

NOT R4, R2 ;2’s complement

ADD R4, R4, #1

ADD R4, R3, R4

BRn CF\_LOOP\_END ; if i >= length, end

ADD R5, R1, R2

LDR R6, R5, #0

; Check if char is between 'A' and 'Z'

LD R7, ASCII\_A

NOT R4, R7

ADD R4, R4, #1

ADD R4, R6, R4

BRn CF\_SKIP\_CHAR ; skip if < 'A'

LD R7, ASCII\_Z ;

NOT R5, R7

ADD R5, R5, #1

ADD R5, R6, R5

BRp CF\_SKIP\_CHAR ; skip if > 'Z'

; R4 = index in FREQ\_TABLE

LEA R7, FREQ\_TABLE ;Load address of freq table in R7

ADD R7, R7, R4

LDR R5, R7, #0

ADD R5, R5, #1

STR R5, R7, #0

CF\_SKIP\_CHAR

ADD R2, R2, #1

BR CF\_LOOP\_START

CF\_LOOP\_END

RET

; -----------------------------

; Subroutine: PRINT\_FREQ

; Prints A: x for each letter with its frequency

PRINT\_FREQ

LEA R1, FREQ\_TABLE

AND R2, R2, #0 ; i = 0

PF\_LOOP

LD R3, NEG\_26

ADD R3, R2, R3 ; i - 26

BRzp PF\_DONE ; if i >= 26, end

ADD R4, R1, R2

LDR R5, R4, #0 ; frequency

LD R6, ASCII\_A

ADD R6, R6, R2 ; current letter

ADD R0, R6, #0

OUT

LD R0, COLON\_CHAR

OUT

LD R0, SPACE\_CHAR

OUT

LD R7, ASCII\_0

ADD R0, R5, R7 ; convert digit to ASCII

OUT

LD R0, NEWLINE

OUT

ADD R2, R2, #1

BR PF\_LOOP

PF\_DONE

RET

; -----------------------------

; Error handler

ERR

AND R0, R0, #0

LEA R0, ERR\_MSG

PUTS

HALT

; -----------------------------

; Data Section

USER\_PROMPT .STRINGZ "Please input a name: "

ENDMSG .STRINGZ "Thank you for your input."

ERR\_MSG .STRINGZ "Error - input is greater than 30 characters"

STR\_ARR .BLKW #30

FREQ\_TABLE .BLKW #26

INDEX .FILL x3101

STR\_PTR .FILL x3102

STR\_LEN .FILL x3104

FREQ .FILL x3103

; Constants

ASCII\_A .FILL x0041

ASCII\_Z .FILL x005A

ASCII\_0 .FILL x0030

COLON\_CHAR .FILL x003A

SPACE\_CHAR .FILL x0020

NEWLINE .FILL x000A

NEG\_30 .FILL #-30

NEG\_26 .FILL #-26

.END