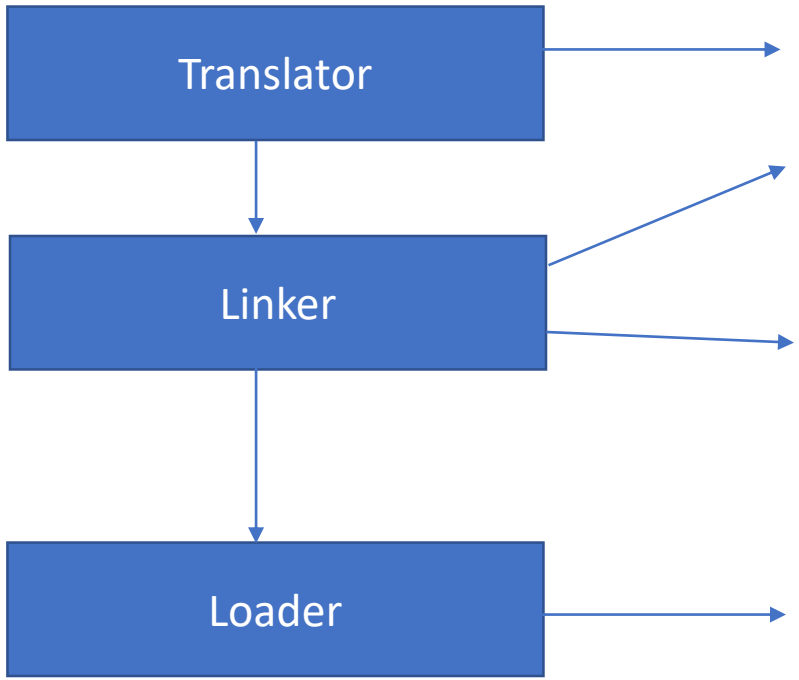
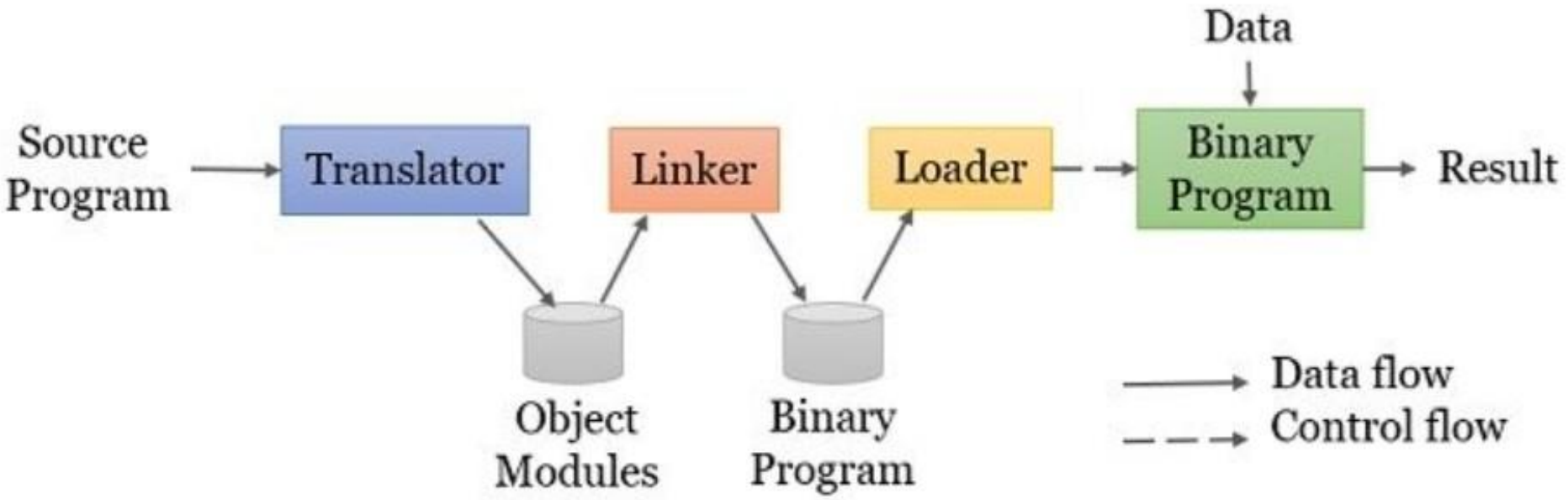
Relocation and Linking Concept in Linkers

Execution Steps of a Program



- Translation of a program
- Linking of program with other programs needed for its execution
- Relocation of the program to execute from the specific memory area allocated to it
- Loading of the program in the memory for the purpose of execution.

Schematic of Program Execution



Schematic Execution of the Program

Terminologies Used for Program Entity at Different Times

- Translation Time (or Translated) Address:
  - Address assigned by the Translator
- Linked Address:
  - Address assigned by the Linker
- Load Time (or Load) Address:
  - Address assigned by the Loader

Terminologies Used for Program Entity at Different Times

- Translated Origin:
  - Address of the origin assumed by the translator
  - This is the address specified by the programmer in an ORIGIN statement.
- Linked Origin:
  - Address of the origin assigned by the linker while producing a binary program
- Load Origin:
  - Address of the origin assigned by the loader while loading the program for execution.

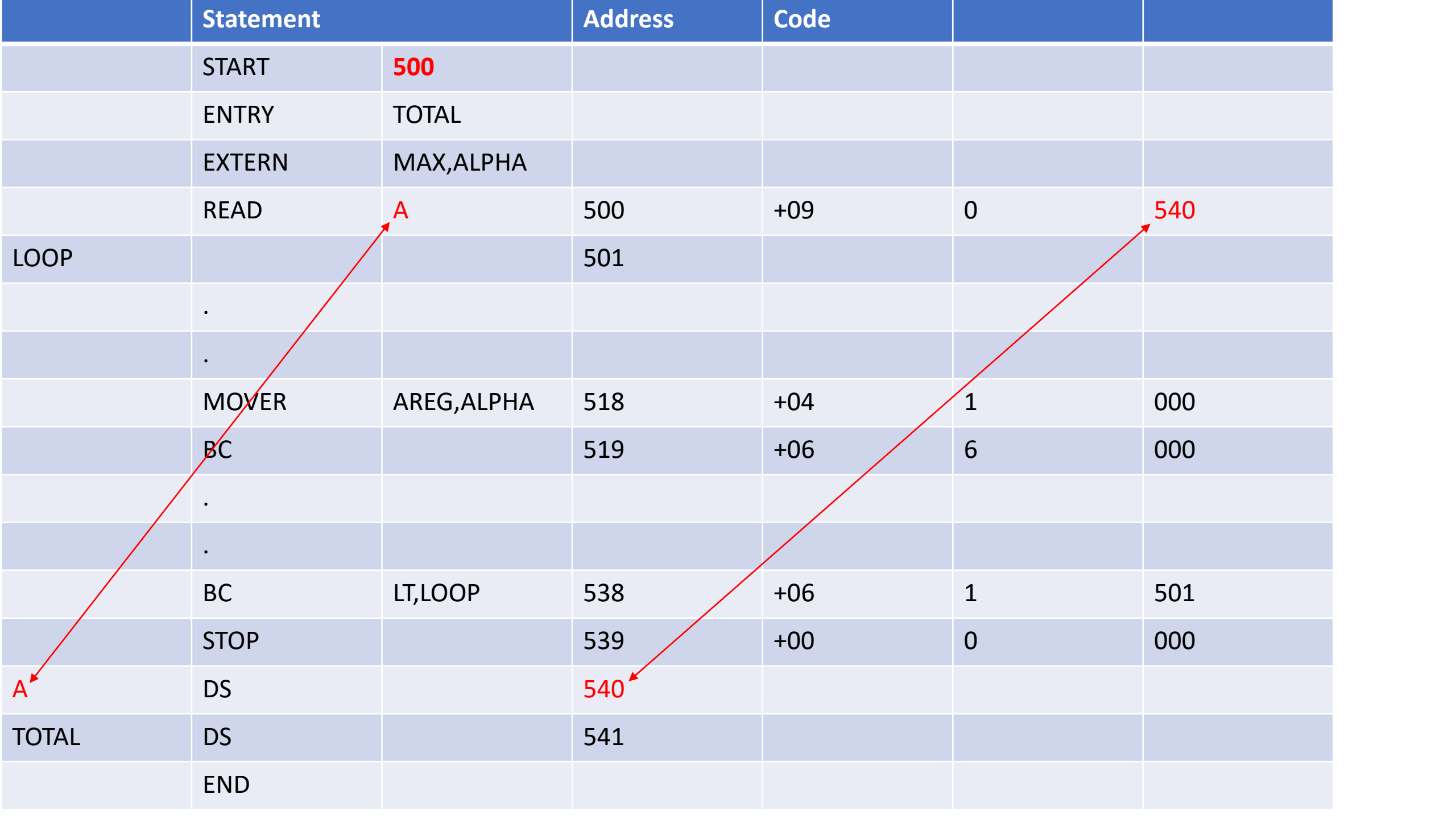
The linked and load origins may differ from translated origin

- Reasons:
  - Same set of translated addresses may have been used by different object modules of the program. This results in conflict in memory allocation.
  - OS may require that a program should execute from a specific area of memory. This may require change in its origin, thus changing execution start address and symbol addresses.
- Thus, changes in origin by linker and loader may be required

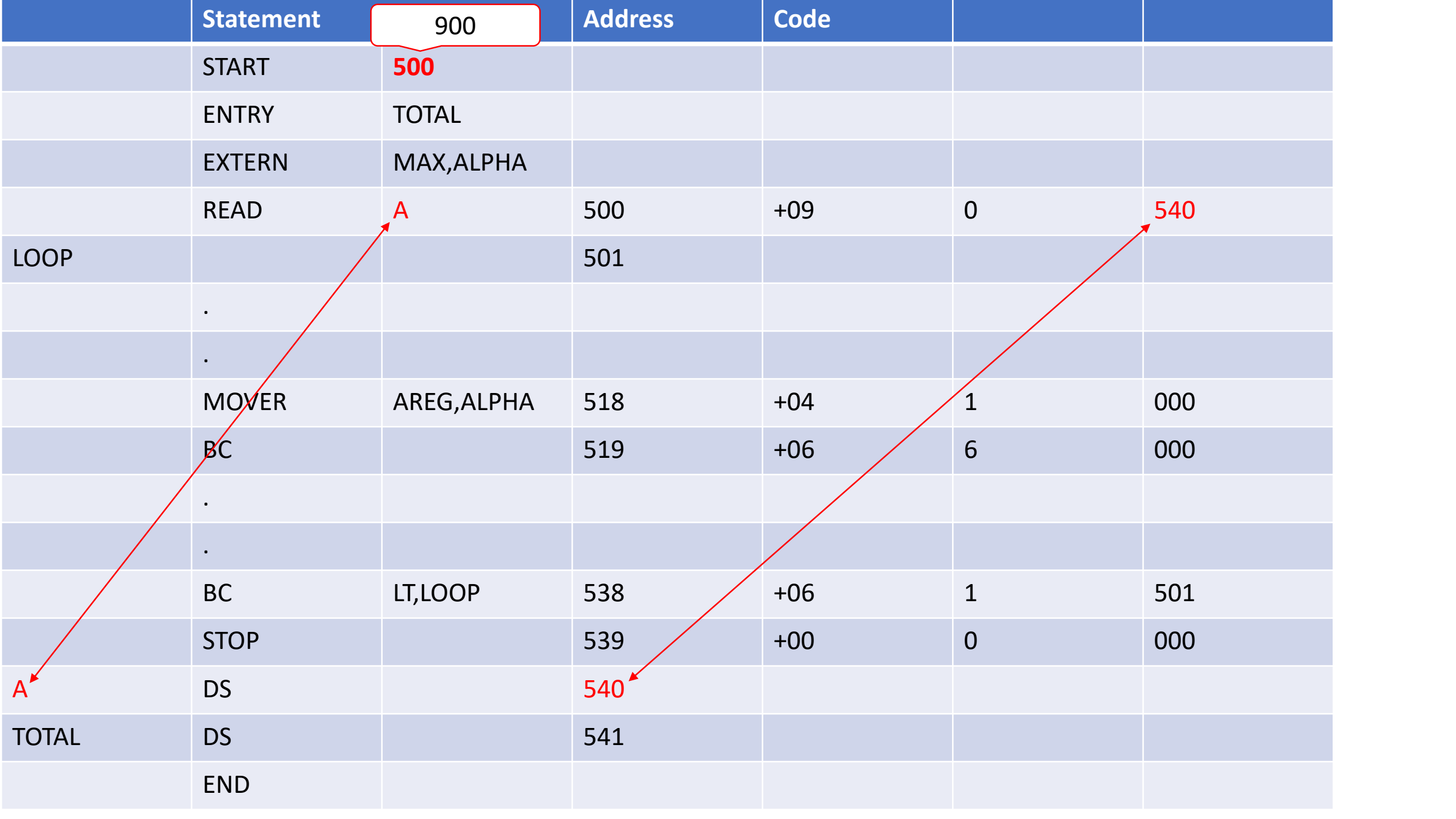
	Statement		Address	Code		
	START	500				
	ENTRY	TOTAL				
	EXTERN	MAX,ALPHA				
	READ	A	500	+09	0	540
LOOP			501			
	.					
	.					
	MOVER	AREG,ALPHA	518	+04	1	000
	BC		519	+06	6	000
	.					
	.					
	BC	LT,LOOP	538	+06	1	501
	STOP		539	+00	0	000
A	DS		540			
TOTAL	DS		541			
	END					

	Statement	Translated Address	Address	Code		
	START	500				
	ENTRY	TOTAL				
	EXTERN	MAX,ALPHA				
	READ	A	500	+09	0	540
LOOP			501			
	.					
	.					
	MOVER	AREG,ALPHA	518	+04	1	000
	BC		519	+06	6	000
	.					
	.					
	BC	LT,LOOP	538	+06	1	501
	STOP		539	+00	0	000
A	DS		540			
TOTAL	DS		541			
	END					

	Statement		Address	Code		
	START	**500**				
	ENTRY	TOTAL				
	EXTERN	MAX,ALPHA				
	READ	A	500	+09	0	540
LOOP			501			
	.					
	.					
	MOVER	AREG,ALPHA	518	+04	1	000
	BC		519	+06	6	000
	.					
	.					
	BC	LT,LOOP	538	+06	1	501
	STOP		539	+00	0	000
A	DS		540			
TOTAL	DS		541			
	END					



	Statement	900	Address	Code		
	START	**500**				
	ENTRY	TOTAL				
	EXTERN	MAX,ALPHA				
	READ	A	500	+09	0	540
LOOP			501			
	.					
	.					
	MOVER	AREG,ALPHA	518	+04	1	000
	BC		519	+06	6	000
	.					
	.					
	BC	LT,LOOP	538	+06	1	501
	STOP		539	+00	0	000
A	DS		540			
TOTAL	DS		541			
	END					



Program Relocation

Consider,

- AA – Set of Absolute Addresses , may be instruction address or data address.
- AA ≠ ∅ : means instruction or data occupy memory words with specific address.

Address Sensitive Program Contains:

- Address Sensitive Instruction: an instruction which contains address.
- Address Constant: a data word which contains an address.

Program Relocation

- Address Sensitive Program P can execute correctly only if the start address of the memory area allocated to it is the same as its translated origin.

Start Address = = Translation Address

- Thus, to execute correctly from any memory area, address used in each address sensitive instruction of P must be 'corrected'.

Program Relocation Definition

- The process of modifying the addresses used in the address sensitive instructions of a program such that the program can execute correctly from the designated area of memory.

- If Linked origin ≠ Translated origin, then relocation is performed by Linker.
- If Load origin ≠ Linked origin, then relocation is performed by Loader.
- In general, linker always performs the relocation.