

**OPCODES, BASE CONVERSION, ASCII SYMBOLS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CAGD  Opcode  (15:12) | Binary | Decimal | Hexadecimal | ASCII  Character |
| add | 0000 | 0 | 0 | NUL |
| addi | 0001 | 1 | 1 | SOH |
| sub | 0010 | 2 | 2 | STX |
| mul | 0011 | 3 | 3 | ETX |
| beq | 0100 | 4 | 4 | EOT |
| bnq | 0101 | 5 | 5 | ENQ |
| blt | 0110 | 6 | 6 | ACK |
| bgt | 0111 | 7 | 7 | BEL |
| bgte | 1000 | 8 | 8 | BS |
| bgtz | 1001 | 9 | 9 | HT |
| j | 1010 | 10 | a | LF |
| in | 1011 | 11 | b | VT |
| out | 1100 | 12 | c | FF |

**CAGD** Reference Data

**CORE INSTRUCTION SET**

NAME, MNEMONIC

FOR-MAT

OPERATION

OPCODE

Add

Addi

Subtract

Multiply

Branch On Equal

Branch On Not Equal

Branch Less Than

Branch Greater Than

Branch Greater Than Or Equal

Branch Less Than Or Equal To Zero

Jump

Input

Output

Load Word

Save word

R[rd] = R[rs] + R[rt]

R[rd] = R[rs] + 0

R[rd] = R[rs] - R[rt]

R[rd] = R[rs] \* R[rt]

If(R[rs]==R[rt])

PC= BranchAddr

If(R[rs]!=R[rt])

PC=BranchAddr

If(R[rs]<R[rt])

PC=Label

If(R[rs]>R[rt])

PC=Label

If(R[rs]>=R[rt])

PC=Label

If(R[rs]<R[rt])

PC=Label

PC = JumpAddr

J

add

addi

sub

mul

beq

bnq

blt

bgt

bgte

bgtz

j

in

out

lw

sw

0000

0001

0010

0011

0100

0101

0110

0111

1000

1001

1010

1011

1100

1101

1110

R

I

R

R

I

I

I

I

I

I

J

I

I

I

I

|  |  |  |
| --- | --- | --- |
| NAME | NUMBER | USE |
| $r0-$r7 | 0-7 | Temporaries |
| $at | 8 | Assembler Temporary |
| $ip | 9 | Pointer for Input |
| $op | 10 | Pointer for Output |
| $gp | 11 | Global Pointer |
| $0 | 12 | Zero |

DATA MEMORY

(RAM)

0hex

$ip

$op

Input Data

Output Data

20hex

40hex

Higher

Memory

Addresses

Lower

Memory

Addresses

Stack

Grows

8-byte

INSTRUCTION MEMORY

(ROM)

18-byte

$gp

0hex

100hex

Reserved

Higher

Memory

Addresses

Lower

Memory

Addresses

Stack

Grows

0

opcode

rs

rt

rd

R

0

3

4

8

70

11

15

12

16

19

opcode

rs

rt

immediate

I

19

16

11

15

120

8

7

0

**CAGD Refence card (“Green Card”)**

**CAGD Refence card (“Green Card”)**

**MEMORY ALLOCATION**

opcode

address

JK

19

16

15

0

**BASIC INSTRUCTION FORMATS**

**REGISTER NAME. NUMBER, USE**

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