ASSIGNMENT NO. 11

AIM :- Write 80387 ALP to obtain: i) Mean ii) Variance iii) Standard Deviation Also plot the histogram for the data set. The data elements are available in a text file.

APPARATUS :

- Core 2 duo/i3/i5/i7 - 64bit processor
- OS – ubuntu 32bit/64bit OS
- Assembler used –nasm (the netwide assembler)
- Editor Used – gedit

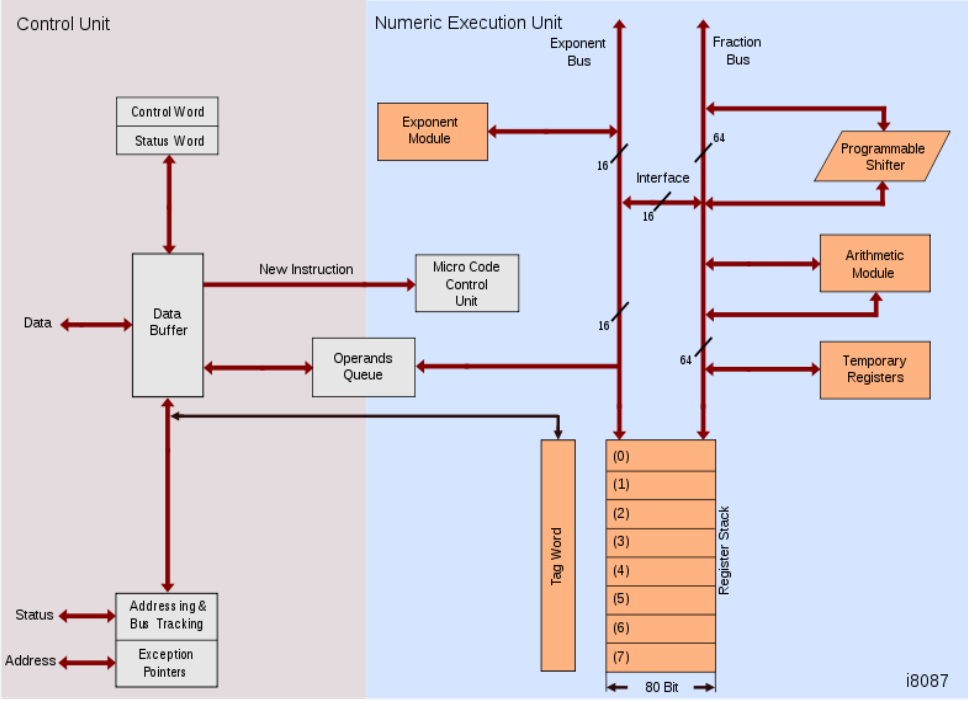
THEORY :

1. Introduction:

1. 8087 was the first math coprocessor for 16-bit processors designed by Intel. It was built to pair with 8086 and 8088.
2. The purpose of 8087 was to speed up the computations involving floating point calculations.
3. Addition, subtraction, multiplication and division of simple numbers is not the coprocessor's job.
4. It does all the calculations involving floating point numbers like scientific calculations and algebraic functions.
5. By having a coprocessor, which performs all the calculations, it can free up a lot of CPU's time.
6. This would allow the CPU to focus all of its resources on the other functions it has to perform.
7. This increases the overall speed and performance of the entire system.

8. This coprocessor introduced about 60 new instructions available to the programmer.
9. All the mnemonics begin with “F” to differentiate them from the standard 8086 instructions.
10. For e.g.: in contrast to ADD/MUL, 8087 provide FADD/FMUL.
11. Math coprocessor is also called as:
    - Numeric Processor Extension (NPX)
    - Numeric Data Processor (NDP)
    - Floating Point Unit (FPU)

2. ARCHITECTURE OF 8087



The internal structure of 8087 coprocessor is divided into two major sections:

- **Control Unit (CU)**
- **Numerical Execution Unit (NEU)**

CONTROL UNIT (CU)

- It interfaces coprocessor to the microprocessor system bus.
- It also synchronize the operation of the coprocessor and the microprocessor.
- This unit has a Control Word, Status Word and Data Buffer.
- If an instruction is ESC instruction, then coprocessor executes it.
- If not, then microprocessor executes.

NUMERIC EXECUTION UNIT (NEU)

- This unit is responsible for executing all coprocessor instructions.
- It has an 8 register stack that holds the operands for instructions and result ofinstructions.
- The stack contains 8 registers that are 80-bits wide.
- Numeric data is transferred inside the coprocessor in two parts:
  - 64-bit mantissa bus
  - 16-bit exponent bus

3. INSTRUCTION SET

The 8087 instruction mnemonics begins with the letter F which stands for Floating point and dis- tinguishes from 8086. These are grouped into Four functional groups. The 8087 detects an error condition usually called an exception when it executing an instruction it will set the bit in its Status register.

- Data Transfer Instructions.
- Arithmetic Instructions.
- Compare Instructions.
- Transcendental Instructions. (Trigonometric And Exponential)

A. DATA TRANSFERS INSTRUCTIONS

REAL TRANSFER

FLD Load real

FST Store real

FSTP Store real and pop

FXCH Exchange registers

INTEGER TRANSFER

FILD Load integer

FIST Store integer

FISTP Store integer and pop

PACKED DECIMAL TRANSFER(BCD)

FBLD Load BCD

FBSTP Store BCD and pop

B. ARITHMETIC INSTRUCTIONS

Addition

FADD Add real

FADDP Add real and pop

FIADD Add integer

Subtraction

FSUB Subtract real

FSUBP Subtract real and pop

FISUB Subtract integer

FSUBR Subtract real reversed

FSUBRP Subtract real and pop

FISUBR Subtract integer reversed

Multiplication

FMUL Multiply real

FMULP Multiply real and pop

FIMUL Multiply integer

Advanced (Other Arithmetic Operations)

FABS Absolute value

FCHS Change sign

FPREM Partial remainder

FPRNDINT Round to integer

FSCALE Scale

FSQRT Square root

FXTRACT Extract exponent and mantissa.

C. COMPARE INSTRUCTIONS

Comparison

FCOM Compare real

FCOMP Compare real and pop

FCOMPP Compare real and pop twice

FICOM Compare integer

FICOMP Compare integer and pop

FTST Test ST against +0.0

FXAM Examine ST

D. TRANSCENDENTAL INSTRUCTION

(TRIGONOMETRIC AND EXPONENTIAL)

Transcendental

FPTAN Partial tangent

FPATAN Partial arctangent

F2XM1 2x - 1

FYL2X Y log2X

FYL2XP1 Y log2(X+1)

Load Constant Instruction

FLDZ Load +0.0

FLDI Load+1.0

FLDPI Load π

FLDL2T Load log210

FLDL2E Load log2e

FLDLG2 Load log102

FLDLN2 Load loge2

Write an 8087 program that loads three values for X, Y, and Z, adds them, and stores the result.

Solution:

```
finit          ;initialize the 8087 to start at the top of stack
fld    X       ;load X into ST(0). now ST(0)=X
fld    Y       ;load Y into ST(0). now ST(0)=Y and ST(1)=X
fld    Z       ;load Z into ST(0). now ST(0)=Z,ST(1)=Y,ST(2)=X
fadd   ST(1)   ;add Y to Z and save the result in ST(0)
fadd   ST(2)   ;add X to (Y+Z) and save it in ST(0)
fst    sum     ;store ST(0) in memory location called sum.
```

Now the same program can be written as follows:

```
finit
fld    X       ;load x, now ST(0) = x
fld    Y       ;load y, now ST(0)= y, ST(1) = x
fld    Z       ;load z, now ST(0)=z, ST(1)=y, ST(2)=x
fadd           ;adds y to z
fadd   ST(2)   ;adds x to (y + z)
fst    sum
```

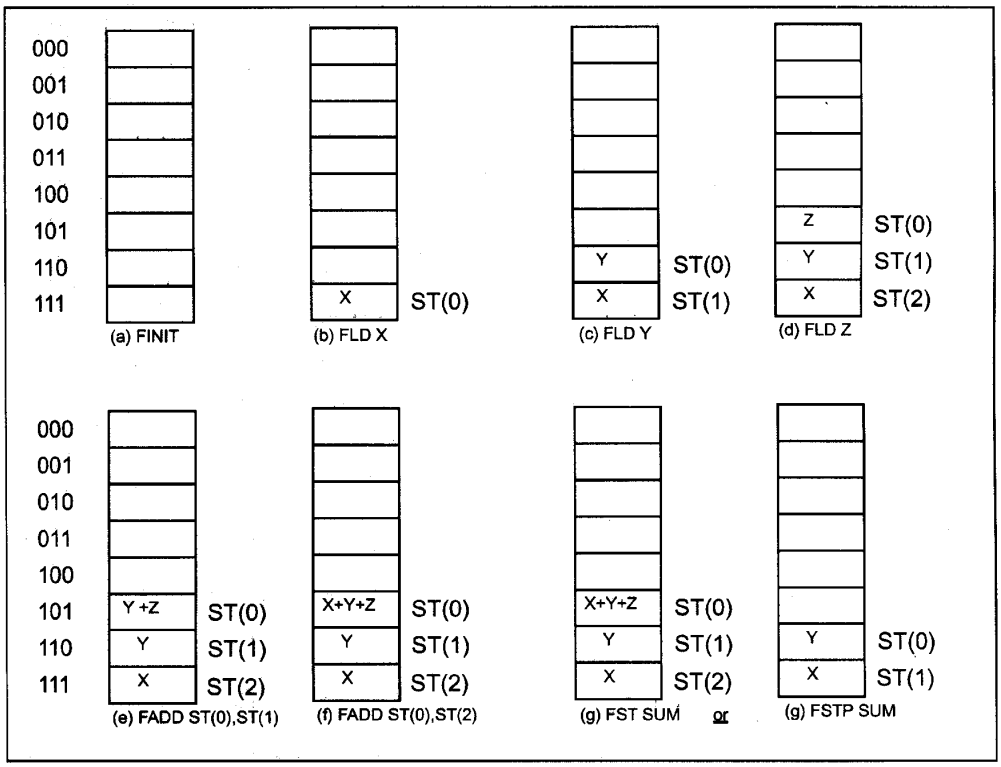


Figure 20-2. Stack Diagram for Example 20-5

CONCLUSION: