AMD

AMD Processor Recognition

Code Sample

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AMD Processor Recognition Code Sample

This document contains a code sample that uses the CPUID instruction to identify the processor and its features. The code was compiled with the Borland C++ compiler v5.0.

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DEFINES Header File (defines.h file)

```
// defines.h : HEADER FILES
#ifndef _H_DEFINES
#define _H_DEFINES

class cpuid {
public:
  int chkcpubit(void);
  int chkcpuid(void);
  void std_vendor_id_str (void);
  void std_cpu_signature(void);
  void ext_vendor_id_str (void);
  void ext_cpu_signature(void);
  void ext_cpu_name_str(void);
  void ext_cpu_cache_info(void);
  };
#endif
```

Main Module (cpuid.cpp file)

```
#pragma inline
#include <fstream.h>
#include <iomanip.h>
#include <iostream.h>
#include <stdlib.h>
#include <string.h>
#include <conio.h>
#include <dos.h>
#include "DEFINES.H"

cpuid k86;                                  //Object of cpuid class

// This function displays part of screen 1 and calls other screens
int main(void)
{
 int maxnum;                                //Variable of the case statement
 int result = 0;                            //Variable of the result
 int func = 3;                              //Variable of the control loop

 result = k86.chkcpubit();                  //Check ID bit in EFLAGS
 if(result == -1) {
      clrscr();
      cout << "\n\n";
      cout << " CPUID instruction is not supported by this processor.";
      cout << "\n\n";
      exit(1);
 }

 else {
      result = k86.chkcpuid();              //Check vendor id string
      if(result == 1) {
        clrscr();
        cout << "\n\n";
        cout << "AMD-K86 CPU supporting CPUID is in place.";
        cout << "\n\n";
      }
      else {
        clrscr();
        cout << "\n\n";
        cout << "CPU supporting CPUID is in place.";
        cout << "\n\n";
        }
 }

 //These are the standard functions
 k86.std_vendor_id_str();
 k86.std_cpu_signature();
```

```
 //These are the extended functions
 for (maxnum=0; maxnum<=func; maxnum++)  {
       switch (maxnum) {
            case 0 : k86.ext_vendor_id_str();   //Vendor Identification String
                          break;
            case 1 : k86.ext_cpu_signature();   //Processor Signature
                          break;
            case 2 : k86.ext_cpu_name_str();    //Processor Name String
                          break;
            case 3 : k86.ext_cpu_cache_info();  //Processor Cache Information L1
                          break;
      }
 }
      return 0;
}
```

CHKCPUBIT Module (chkcpubit.cpp file)

```
#include "DEFINES.H"

// This function checks the processor ID bit (bit 21) in the EFLAGS register.
// The program aborts if the processor does not implement the CPUID instruction.

int cpuid::chkcpubit(void)
{
  asm {
             .486
             pushfd                        //Save EFLAGS
             pop     eax
             test    eax,0x00200000        //Check ID bit (bit 21)
             jz      set_21                //Bit 21 is not set, so jump to set_21
             and     eax,0xffdfffff        //Clear bit 21
             push    eax                   //Save new value in register
             popfd                         //Store new value in flags
             pushfd
             pop     eax
             test    eax,0x00200000        //Check ID bit
             jz      cpu_id_ok             //If bit 21 is clear,then jump to cpu_id_ok
             jmp     err                   //If bit 21 is set, CPUID instruction is
            }                              //not supported
            set_21:
            asm {
             or      eax,0x00200000        //Set bit 21
             push    eax                   //Store new value
             popfd                         //Store new value in EFLAGS
             pushfd
             pop     eax
             test    eax,0x00200000        //If bit 21 is on
             jnz     cpu_id_ok             //then jump to cpu_id_ok
            }
            err:
            asm {
             mov     eax,0xffffffff        //CPUID instruction is not supported
             jmp     exit                  //so exit
            }
            cpu_id_ok:                     //Support CPUID instruction
            asm  mov eax,0                 //Return 0

            exit:
            if(_EAX == 0xffffffff){
                  return (-1);
            }
            if (_EAX == 0x0) {
                  return (0);
            }
}
```

CHKCPUID Module (chkcpuid.cpp file)

```
#include "DEFINES.H"
#include <iomanip.h>
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <string.h>

//chkcpuid identifies the processor name string.

int cpuid::chkcpuid()
{
  char idstr[13];                          //Vendor string variable


  asm {
       mov    eax,0x0                     //EAX = 0
       db     0x0F,0xA2                   //CPUID opcode
  }

  //Store the 12 character ASCII string
  idstr[0] = _BL;
  idstr[1] = _BH;
  asm {
      ror ebx,0x10
  }
  idstr[2] = _BL;
  idstr[3] = _BH;
  idstr[4] = _DL;
  idstr[5] = _DH;
  asm {
      ror edx,0x10
  }
  idstr[6] = _DL;
  idstr[7] = _DH;
  idstr[8] = _CL;
  idstr[9] = _CH;
  asm {
       ror  ecx,0x10
  }
  idstr[10] = _CL;
  idstr[11] = _CH;
  idstr[12] = '\0';

  if ( strcmp(idstr, "AuthenticAMD") != 0 )
       return (0);
  else
       return (1);
}
```

STD_VENDOR_ID_STR Module (cpuidstr.cpp file)

```
#include "DEFINES.H"
#include <iomanip.h>
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <string.h>

//Vendor_id_str() finds the largest function value recognized by
//AMD processors. It also identifies AMD as the vendor for the CPU
//by returning "AuthenticAMD" in idstr. If another vendor's identification
//is returned, the program aborts.

// This function displays part of screen 1
void cpuid::std_vendor_id_str()
{
  char idstr[13];                          //Vendor string variable
  int largest_func = 0;                    //Largest function variable
  unsigned long   reg_eax,                 //Register variables
                  reg_ebx,
                  reg_ecx,
                  reg_edx;

  asm {
            mov    eax,0x0                 //EAX = 0
            db     0x0F,0xA2               //CPUID opcode
  }
  reg_eax = _EAX;                          //Store the vendor identification string
  reg_ebx = _EBX;
  reg_edx = _EDX;
  reg_ecx = _ECX;

  largest_func = _EAX;                     //The largest function value

  idstr[0] = _BL;                          //Get the 12 character ASCII string
  idstr[1] = _BH;                          //that identifies AMD as the vendor
  asm {                                    //of the CPU.
            ror ebx,0x10
  }
  idstr[2] = _BL;
  idstr[3] = _BH;
  idstr[4] = _DL;
  idstr[5] = _DH;
  asm {
            ror edx,0x10
  }
  idstr[6] = _DL;
  idstr[7] = _DH;
  idstr[8] = _CL;
  idstr[9] = _CH;
```

```
  asm {
            ror  ecx,0x10
  }
  idstr[10] = _CL;
  idstr[11] = _CH;
  idstr[12] = '\0';
  cout.setf(ios::uppercase);
  cout << "\nFunction 0 (EAX = 0)" << endl;
  cout << "====================";
  cout << "\n\n";

  cout << "EAX == " << setw(8) << setfill('0') << hex << reg_eax;
  cout << "   EBX == " << setw(8) << hex << reg_ebx;
  cout << "   ECX == " << setw(8) << hex << reg_ecx;
  cout << "   EDX == " << setw(8) << hex << reg_edx;
  cout << "\n\n";
  cout << "     Largest Function Input Value : " << largest_func;

  cout << "\n\n";
  cout << "     Vendor Identification String : " << idstr;
  cout.unsetf(ios::uppercase);
  if ( strcmp(idstr, "AuthenticAMD") != 0 )           //If not AMD, then abort
      {
       cout <<"\n\n\n\n";
       cout <<"     This is not an AMD-K86 processor." << "\n\n";
       exit(1);
      }
      cout<< "\n\n\n                Press any key for more." << "\n\n";
      getch();

}
```

STD_CPU_SIGNATURE Module (cpuname.cpp file)

```
#include "DEFINES.H"
#include <iostream.h>
#include <iomanip.h>
#include <stdlib.h>
#include <conio.h>

//cpu_signature identifies the specific CPU by providing information regarding
//the type, instruction family, model, stepping revision, and the feature flags.
//The feature flags indicate the presence of specific features.

// This function displays screen 2 and screen 3
void cpuid :: std_cpu_signature (void)
{
  int signature = 0;                        //CPU signature variable
  int stepping_id = 0;                      //CPU stepping id variable
  int model = 0;                            //CPU model variable
  int inst_family = 0;                      //CPU instruction fammily variable
  unsigned int reg_ax = 0 ;                 //AX register
  unsigned long reg_eax,reg_edx, test_reg;  //EAX, EDX, and test register variables
  unsigned long print_eax,print_ebx,print_ecx,print_edx;   //Display variable
  int maxbit = 18;                          //Control loop variable
  int bits ;

  asm {
            mov EAX,1                       //EAX = 1 or function 1
            db 0x0F, 0xA2                   //CPUID opcode
  }
  //Display the value of the registers
  print_eax = _EAX;
  print_ebx = _EBX;
  print_ecx = _ECX;
  print_edx = _EDX;

  reg_edx = _EDX;                           //Store the standard feature flags
  reg_ax = _AX;
  asm mov BX, reg_ax
  asm  and BL,0x0F                          //Mask the right-most 4 bits
  stepping_id = _BL;                        //to get the CPU stepping id

  asm  mov BX, reg_ax
  asm  and BL,0xF0                          //Mask the left-most 4 bits
  asm  ror BL,4                             //to get the CPU model
  model = _BL;

  asm mov BX, reg_ax                        //Get the CPU instruction family
  asm and BH, 0x0F
  inst_family = _BH;
```

```
asm and EAX,0xFFFFF000                  //Get the bits[31-12]
asm ror EAX,12
reg_eax = _EAX;

asm mov BX, reg_ax                      //Get the CPU signature
asm and BX,0x0FF0
signature = _BX;

clrscr();
cout.setf(ios::uppercase);
cout << "Function 1 (EAX = 1)" << endl;
cout << "====================";
cout << "\n\n";
cout << "EAX == "<< setw(8) << hex << print_eax;
cout << "  EBX == "<< setw(8) << hex << print_ebx;
cout << "  ECX == "<< setw(8) << hex << print_ecx;
cout << "  EDX == "<< setw(8) << hex << print_edx;
cout.unsetf(ios::uppercase);
cout << "\n\n";
cout << "     EAX[3:0]   == " << setw(1) << hex << stepping_id << endl;
cout << "     EAX[7:4]   == " << setw(1) << hex << model << endl;
cout << "     EAX[11:8]  == " << setw(1) << hex << inst_family << endl;
cout << "     EAX[31:12] == " << setw(5) << hex << reg_eax << endl;

cout << "\n\n";
cout << "     Processor Signature : ";

if (signature == 0x0500)
     cout << "AMD-K5 (Model 0) " << endl;
else if (signature == 0x0510)
     cout << "AMD-K5 (Model 1) " << endl;
else if (signature == 0x0520)
     cout << "AMD-K5 (Model 2) " << endl;
else if (signature == 0x0530)
     cout << "AMD-K5 (Model 3) " << endl;
else if (signature == 0x0560)
     cout << " AMD-K6 (Model 6)" << endl;
else if (signature == 0x0570)
     cout << " AMD-K6 (Model 7)" << endl;
else if (signature == 0x0580)
     cout << " AMD-K6-2 (Model 8)" << endl;
else if (signature == 0x0590)
     cout << " AMD-K6-3 (Model 9)" << endl;
else if (signature == 0x0400)
     cout << "Am486 and Am5X86 " << endl;
cout << "\n\n             Press any key for more."<<"\n\n";
getch();

clrscr();
cout << "\n";
cout << "     Standard Feature Flags : " << "\n\n";
```

```
cout << "          EDX == ";
cout.setf(ios::uppercase);
cout << setw(8) << hex << reg_edx << "\n\n";
cout.unsetf(ios::uppercase);

//Get the standard feature flags
for ( bits = 0; bits < maxbit; bits++){
     switch (bits) {
          case 0 : test_reg = reg_edx;
                if((test_reg & 0x00000001)== 0x00000001){       //Test bit 0
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[0]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 0==1 indicates FPU present)" << endl;
                      }
                      else {
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[0]  = 0b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 0==1 indicates FPU present)" << endl;
                      }
                      test_reg = reg_edx;
                      break;
          case 1 : if ((test_reg & 0x00000002 )==0x00000002){   //Test bit 1
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[1]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 1==1 indicates Virtual Mode Extensions)"
                             << endl;
                      }
                      else {
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[1]  = 0b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 1==1 indicates Virtual Mode Extensions)"
                             << endl;
                      }
                      test_reg = reg_edx;
                      break;
          case 2 : if ((test_reg & 0x00000004 )==0x00000004){   //Test bit 2
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[2]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 2==1 indicates Debugging Extensions)"
                             << endl;
                      }
```

```
                else {
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[2]  = 0b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 2==1 indicates Debugging Extensions )"
                       << endl;
                }
                test_reg = reg_edx;
                break;

        case 3 : if ((test_reg & 0x00000008 )==0x00000008){   //Test bit 3
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[3]  = 1b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 3==1 indicates Page Size Extensions)"
                       << endl;
                }
                else {
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[3]  = 0b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 3==1 indicates Page Size Extensions)"
                       << endl;
                }
                test_reg = reg_edx;
                break;
        case 4 : if ((test_reg & 0x00000010 )==0x00000010){   //Test bit 4
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[4]  = 1b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 4==1 indicates Time Stamp Counter)"
                       << endl;
                }
                else {
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[4]  = 0b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 4==1 indicates Time Stamp Counter )"
                       << endl;
                }
                test_reg = reg_edx;
                break;
        case 5 : if ((test_reg & 0x00000020 )==0x00000020){   //Test bit 5
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[5]  = 1b ";
```

```
                cout.unsetf(ios::left);
                cout << " (bit 5==1 indicates K86 Model Specific Registers)"
                     << endl;
              }
              else {
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[5]  = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 5==1 indicates K86 Model Specific Registers)"
                     << endl;
              }
              test_reg = reg_edx;
              break;
case 6 : if ((test_reg & 0x00000040 )==0x00000000){   //Test bit 6
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[6]  = 0b";
                cout.unsetf(ios::left);
                cout << "  Reserved" << endl;
              }
              test_reg = reg_edx;
              break;
case 7 : if ((test_reg & 0x00000080 )==0x00000080){   //Test bit 7
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[7]  = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 7==1 indicates Support of Machine";
                cout << " Check Exception)" << endl;
              }
              else {
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[7]  = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 7==1 indicates Support of Machine";
                cout << " Check Exception)" << endl;
              }
              test_reg = reg_edx;
              break;
case 8 : if ((test_reg & 0x00000100 )==0x00000100){   //Test bit 8
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[8]  = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 8==1 indicates Support of CMPXCHG8B";
                cout << " Extensions)" << endl;
              }
```

```
                else {
                  cout.width(13);
                  cout.setf(ios::left);
                  cout << "EDX[8]  = 0b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 8==1 indicates Support of CMPXCHG8B";
                  cout << " Extensions)" << endl;
                }
                test_reg = reg_edx;
                break;
case 9 : if ((test_reg & 0x00000200 )==0x00000200){   //Test bit 9
                   if (signature == 0x0500){
                     cout.width(13);
                     cout.setf(ios::left);
                     cout << "EDX[9]  = 1b ";
                     cout.unsetf(ios::left);
                     cout << " (bit 9==1 indicates Support of Global";
                     cout << " Paging Extension)"<< endl;
                   }
                   else {
                     cout.width(13);
                     cout.setf(ios::left);
                     cout << "EDX[9]  = 1b ";
                     cout.unsetf(ios::left);
                     cout << " (bit 9==1 indicates Support of APIC)"
                          << endl;
                   }
                }
                else {
                  if (signature == 0x0500){
                    cout.width(13);
                    cout.setf(ios::left);
                    cout << "EDX[9]  = 0b ";
                    cout.unsetf(ios::left);
                    cout << " (bit 9==1 indicates Support of Global";
                    cout << " Paging Extensions)"<< endl;
                   }
                   else {
                     cout.width(13);
                     cout.setf(ios::left);
                     cout << "EDX[9]  = 0b ";
                     cout.unsetf(ios::left);
                     cout << " (bit 9==1 indicates Support of APIC)"
                          << endl;
                   }
                }
                test_reg = reg_edx;
                break;
case 10 : if ((test_reg & 0x00000C00 )==0x00000000){//Test bits 10:11
                  cout.width(12);
                  cout.setf(ios::left);
```

```
                cout << "EDX[10:11] = ";
                cout.unsetf(ios::left);
                cout << " Reserved"<< endl;
              }
              test_reg = reg_edx;
              break;
case 11 : if ((test_reg & 0x00001000 )==0x00001000){  //Test bit 12
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[12] = 1b";
                cout.unsetf(ios::left);
                cout << " (bit 12==1 indicates Memory Type Range Registers)"
                     << endl;
              }
              else {
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[12] = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 12==1 indicates Memory Type Range Registers)"
                     << endl;
              }
              test_reg = reg_edx;
              break;
case 12 : if ((test_reg & 0x00002000 )==0x00002000){  //Test bit 13
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[13] = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 13==1 indicates Global Paging Extension)"
                     << endl;
               }
               else {
                  if (signature == 0x0500){
                  cout.width(12);
                  cout.setf(ios::left);
                  cout << "EDX[13] = 0b ";
                  cout.unsetf(ios::left);
                  cout << " Reserved" << endl;
                  }
                  else {
                    cout.width(12);
                    cout.setf(ios::left);
                    cout << "EDX[13] = 0b ";
                    cout.unsetf(ios::left);
                    cout << " (bit 13==1 indicates Global Paging Extension)"
                         << endl;
                  }
              }
              test_reg = reg_edx;
              break;
```

```
case 13 : if ((test_reg & 0x00004000 )==0x00000000){  //Test bit 14
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[14] = 0b ";
                cout.unsetf(ios::left);
                cout << " Reserved" << endl;
             }
           test_reg = reg_edx;
           break;
case 14 : if ((test_reg & 0x00008000 )==0x00008000){  //Test bit 15
             cout.width(12);
             cout.setf(ios::left);
             cout << "EDX[15] = 1b ";
             cout.unsetf(ios::left);
             cout << "(bit 15==1 indicates Conditional Move Instruction)"
                  << endl;
           }
           else {
             cout.width(12);
             cout.setf(ios::left);
             cout << "EDX[15] = 0b ";
             cout.unsetf(ios::left);
             cout << "(bit 15==1 indicates Conditional Move Instruction)"
                  << endl;
           }
           test_reg = reg_edx;
           break;
case 15 : if ((test_reg & 0x007F0000 )==0x00000000){//Test bits 16:22
             cout.width(12);
             cout.setf(ios::left);
             cout << "EDX[16:22] = ";
             cout.unsetf(ios::left);
             cout << " Reserved" << endl;
           }
           test_reg = reg_edx;
           break;
case 16 : if ((test_reg & 0x00800000 )==0x00800000){  //Test bit 23
             cout.width(12);
             cout.setf(ios::left);
             cout << "EDX[23] = 1b ";
             cout.unsetf(ios::left);
             cout << " (bit 23==1 indicates Support of MMX(tm)"
                  << " Technology)" << endl;
           }
           else {
             cout.width(12);
             cout.setf(ios::left);
             cout << "EDX[23] = 0b ";
             cout.unsetf(ios::left);
             cout << " (bit 23==1 indicates Support of MMX(tm)"
                  << " Technology)" << endl;
```

```
                        }
                        test_reg = reg_edx;
                        break;
            case 17: if ((test_reg & 0xFF000000) == 0x00000000){ //Test bits 24:31
                          cout.width(12);
                          cout.setf(ios::left);
                          cout << "EDX[24:31] = ";
                          cout.unsetf(ios::left);
                          cout << " Reserved" << endl;
                        }

      }
  }
  cout << "\n                    Press any key for more. " << endl;
  getch();
}
```

EXT_VENDOR_ID_STR Module (extidstr.cpp file)

```
#include "DEFINES.H"
#include <iomanip.h>
#include <iostream.h>
#include <conio.h>
#include <stdlib.h>
#include <string.h>

//ext_vendor_id_str() finds the largest extended function value
//recognized by AMD processors.

//This function displays screen 4

void cpuid::ext_vendor_id_str()
{
  unsigned long   reg_ebx,                //Register variables
                  reg_ecx,
                  reg_edx,
                  largest_func;           //Largest function variable

  asm {
              mov    eax,0x80000000       //EAX = 8000_0000h
              db     0x0F,0xA2            //CPUID opcode
  }
  largest_func = _EAX;                    //The largest function value
  reg_ebx = _EBX;
  reg_edx = _EDX;
  reg_ecx = _ECX;

clrscr();
  cout.setf(ios::uppercase);
  cout << "\nFunction 8000_0000h (EAX = 80000000)" << endl;
  cout << "====================================";
  cout << "\n\n";
  cout << "      EAX == " << setw(8) << hex << largest_func<< endl;;
  cout << "      EBX == " << setw(8) << hex << reg_ebx << endl;
  cout << "      ECX == " << setw(8) << hex << reg_ecx << endl;
  cout << "      EDX == " << setw(8) << hex << reg_edx << endl;
  cout << "\n\n";
  cout.unsetf(ios::uppercase);
  cout << "     Largest Extended Function Input Value : " << largest_func;
  if (largest_func == 0 ) {
    cout << "\n\n";
    cout << "     EBX, ECX, EDX : Undefined " << "\n\n";
    cout << "                     Press any key for more." << endl;
    cout <<"\n\n\n\n";
    getch();
  }
```

```
  else {
    cout << "\n\n";
    cout << "     EBX, ECX, EDX : Reserved " << "\n\n";
    cout << "                        Press any key for more." << endl;
    cout <<"\n\n\n\n";
    getch();
  }
}
```

EXT_CPU_SIGNATURE Module (extname.cpp file)

```
#include "DEFINES.H"
#include <iostream.h>
#include <iomanip.h>
#include <stdlib.h>
#include <conio.h>

//cpu_signature identifies the specific CPU by providing information
//regarding the type, instruction family, model, stepping revision and
//feature flags. The feature flags indicates the presence of specific features.

// This function displays screens 5 and 6
void cpuid :: ext_cpu_signature (void)
{
  int signature = 0;                        //Signature variable
  int stepping_id = 0;                      //Stepping id variable
  int model = 0;                            //Model variable
  int inst_family = 0;                      //Instruction family variable
  unsigned int reg_ax = 0 ;                 //AX register variable
  unsigned long reg_eax,reg_edx,test_reg, //Register variables
            print_eax,print_ebx,print_ecx,print_edx;  //Display variables
  int maxbit = 20;                          //Control loop variable
  int bits ;                                //Case statement variable

  asm {
             mov EAX,0x80000001             //EAX = 8000_0001h
             db 0x0F, 0xA2                  //CPUID opcode
  }
  //Display the value of the registers
  print_eax = _EAX;
  print_ebx = _EBX;
  print_ecx = _ECX;
  print_edx = _EDX;

  reg_edx = _EDX;                           //Store the extended feature flags
  reg_ax = _AX;
  asm mov BX, reg_ax
  asm  and BL,0x0F                          //Mask the right-most 4 bits
  stepping_id = _BL;                        //to get the CPU stepping id

  asm  mov BX, reg_ax
  asm  and BL,0xF0                          //Mask the left-most 4 bits
  asm  ror BL,4                             //to get the CPU model
  model = _BL;

  asm mov BX, reg_ax                        //Get the CPU instruction family
  asm and BH, 0x0F
  inst_family = _BH;
```

```
asm and EAX,0xFFFFF000                  //Get bits[31-12]
asm ror EAX,12
reg_eax = _EAX;

asm mov BX, reg_ax                      //Get the CPU signature
asm and BX,0x0FF0
signature = _BX;

clrscr();
cout.setf(ios::uppercase);
cout << "Function 8000_0001h (EAX = 80000001)" << endl;
cout << "====================================";
cout << "\n\n";
cout << "EAX == "<< setw(8) << hex << print_eax<<"   EBX == " << setw(8)
     << hex << print_ebx << "   ECX == "<< setw (8) << hex << print_ecx
     << "   EDX == " << setw(8) << hex << print_edx << "\n\n";
cout << "     EAX[3:0]   == " << setw(1) << hex << stepping_id << endl;
cout << "     EAX[7:4]   == " << setw(1) << hex << model << endl;
cout << "     EAX[11:8]  == " << setw(1) << hex << inst_family << endl;
cout << "     EAX[31:12] == " << setw(5) << hex << reg_eax << endl;
cout.unsetf(ios::uppercase);

cout << "\n";
cout << "     AMD Processor Signature : ";

if (signature == 0x0660)
     cout << " AMD-K6 (Model 6)" << endl;
else if (signature == 0x0670)
     cout << " AMD-K6 (Model 7)" << endl;
else if (signature == 0x0680)
     cout << " AMD-K6-2 (Model 8)" << endl;
else if (signature == 0x0690)
     cout << " AMD-K6-3 (Model 9)" << endl;
else if (signature == 0x0510)
     cout << " AMD-K5 (Model 1) " << endl;
else if(signature == 0x0520)
     cout << " AMD-K5 (Model 2) " << endl;
else if(signature == 0x0530)
     cout << " AMD-K5 (Model 3) " << endl;
else cout << " Undefined " << endl;

cout << "\n";
cout << "     Extended Feature Flags : " << "\n\n";
cout << "          EDX == ";
cout.setf(ios::uppercase);
cout << setw(8) << hex << reg_edx << "\n\n";
cout.unsetf(ios::uppercase);
cout << "                    Press any key for more. " << endl;
cout << "\n\n";
getch();
clrscr();
```

```
//Get the feature flags
for ( bits = 0; bits <= maxbit; bits++){
     switch (bits) {
          case 0 : test_reg = reg_edx;
                 if((test_reg & 0x00000001)== 0x00000001){      //Test bit 0
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[0]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 0==1 indicates FPU present)" << endl;
                      }
                      else {
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[0]  = 0b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 0==1 indicates FPU present)" << endl;
                      }
                      test_reg = reg_edx;
                      break;
          case 1 : if ((test_reg & 0x00000002 )==0x00000002)    //Test bit 1
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[1]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 1==1 indicates Virtual Mode Extensions)"
                             << endl;
                      }
                      else {
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[1]  = 0b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 1==1 indicates Virtual Mode Extensions)"
                             << endl;
                      }
                      test_reg = reg_edx;
                      break;
          case 2 : if ((test_reg & 0x00000004 )==0x00000004){   //Test bit 2
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[2]  = 1b ";
                        cout.unsetf(ios::left);
                        cout << " (bit 2==1 indicates Debugging Extensions)"
                             << endl;
                      }
                      else {
                        cout.width(13);
                        cout.setf(ios::left);
                        cout << "EDX[2]  = 0b ";
                        cout.unsetf(ios::left);
```

```
                cout << " (bit 2==1 indicates Debugging Extensions )" << endl;
              }
              test_reg = reg_edx;
              break;
case 3 : if ((test_reg & 0x00000008 )==0x00000008){   //Test bit 3
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[3]  = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 3==1 indicates Page Size Extensions)" << endl;
              }
              else {
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[3]  = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 3==1 indicates Page Size Extensions)" << endl;
              }
              test_reg = reg_edx;
              break;
case 4 : if ((test_reg & 0x00000010 )==0x00000010){   //Test bit 4
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[4]  = 1b ";
                cout.unsetf(ios::left);
                 cout << " (bit 4==1 indicates Time Stamp Counter)" << endl;
              }
              else {
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[4]  = 0b ";
                cout.unsetf(ios::left);
                 cout << " (bit 4==1 indicates Time Stamp Counter )"<< endl;
              }
              test_reg = reg_edx;
              break;
case 5 : if ((test_reg & 0x00000020 )==0x00000020){   //Test bit 5
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[5]  = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 5==1 indicates K86 Model-Specific Registers)"
                     << endl;
              }
              else {
                cout.width(13);
                cout.setf(ios::left);
                cout << "EDX[5]  = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 5==1 indicates K86 Model-Specific Registers)"
                     << endl;
```

```
            }
            test_reg = reg_edx;
            break;
case 6 : if((test_reg & 0x00000040) == 0x00000000){   //Test bit 6
              cout.width(13);
              cout.setf(ios::left);
              cout << "EDX[6]  = 0b ";
              cout.unsetf(ios::left);
              cout << " Reserved" << endl;
            }
            test_reg = reg_edx;
            break;
case 7 : if ((test_reg & 0x00000080 )==0x00000080){   //Test bit 7
              cout.width(13);
              cout.setf(ios::left);
              cout << "EDX[7]  = 1b ";
              cout.unsetf(ios::left);
              cout << " (bit 7==1 indicates Support of Machine";
              cout << " Check Exception)" << endl;
            }
            else {
              cout.width(13);
              cout.setf(ios::left);
              cout << "EDX[7]  = 0b ";
              cout.unsetf(ios::left);
              cout << " (bit 7==1 indicates Support of Machine";
              cout << " Check Exception)" << endl;
            }
            test_reg = reg_edx;
            break;
case 8 : if ((test_reg & 0x00000100 )==0x00000100){   //Test bit 8
              cout.width(13);
              cout.setf(ios::left);
              cout << "EDX[8]  = 1b ";
              cout.unsetf(ios::left);
              cout << " (bit 8==1 indicates Support of CMPXCHG8B "
                   << "instruction)" << endl;
            }
            else {
              cout.width(13);
              cout.setf(ios::left);
              cout << "EDX[8]  = 0b ";
              cout.unsetf(ios::left);
              cout << " (bit 8==1 indicates Support of CMPXCHG8B";
              cout << " instruction)" << endl;
            }
            test_reg = reg_edx;
            break;
case 9 : if ((test_reg & 0x00000200 )==0x00000000){   //Test bit 9
              cout.width(13);
              cout.setf(ios::left);
```

```
                  cout << "EDX[9]  = 0b ";
                  cout.unsetf(ios::left);
                  cout << " Reserved" << endl;
                }
                test_reg = reg_edx;
                break;
case 10 : // Bit 10 used to be the SYSCALL/SYSRET bit but later this was
          // changed to bit 11, so now bit 10 is actually reserved;
          // Model 6 shows bit 10 to be set but this is invalid.
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[10] = 0b ";
                cout.unsetf(ios::left);
                cout << " Reserved" << endl;
                test_reg = reg_edx;
                break;
case 11 : if ((test_reg & 0x00000800 )==0x00000800){       //Test bit 11
                  cout.width(12);
                  cout.setf(ios::left);
                  cout << "EDX[11] = 1b";
                  cout.unsetf(ios::left);
                  cout << " (bit 11==1 indicates Support for SYSCALL/SYSRET)"
                       << endl;
                }
                else {
                  cout.width(12);
                  cout.setf(ios::left);
                  cout << "EDX[11] = 0b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 11==1 indicates Support for SYSCALL/SYSRET)"
                       << endl;
                }
                test_reg = reg_edx;
                break;
case 12 : if ((test_reg & 0x00001000 )==0x00000000){      //Test bit 12
                  cout.width(12);
                  cout.setf(ios::left);
                  cout << "EDX[12] = 0b ";
                  cout.unsetf(ios::left);
                  cout << " Reserved" << endl;
                }
                test_reg = reg_edx;
                break;
case 13 : if ((test_reg & 0x00002000 )==0x00002000){      //Test bit 13
                  cout.width(12);
                  cout.setf(ios::left);
                  cout << "EDX[13] = 1b ";
                  cout.unsetf(ios::left);
                  cout << " (bit 13==1 indicates Support of Global Paging "
                       << "Extensions)" << endl;
                }
```

```
            else {
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[13] = 0b ";
              cout.unsetf(ios::left);
              cout << " (bit 13==1 indicates Support of Global Paging "
                   << "Extensions) "<< endl;
            }
            test_reg = reg_edx;
            break;
case 14 : if ((test_reg & 0x00004000 )==0x00000000){  //Test bit 14
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[14] = 0b";
              cout.unsetf(ios::left);
              cout << "  Reserved" << endl;
            }
            test_reg = reg_edx;
            break;
case 15 : if ((test_reg & 0x00008000 )==0x00008000){  //Test bit 15
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[15] = 1b ";
              cout.unsetf(ios::left);
              cout << " (bit 15==1 indicates Support of Integer "
                   << "Conditional Move" << endl;
              cout << "              Instructions)" << endl;
            }
            else {
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[15] = 0b ";
              cout.unsetf(ios::left);
              cout << " (bit 15==1 indicates Support of Integer"
                   << " Conditional Move" << endl;
              cout << "              Instructions)" << endl;
            }
            test_reg = reg_edx;
            break;
case 16 : if ((test_reg & 0x00010000) == 0x00010000){ //Test bit 16
            out.setf(ios::left);
              cout << "EDX[16] = 1b ";
              cout.unsetf(ios::left);
              cout << " (bit 16==1 indicates Support of Floating-Point"
                   << " Conditional Move" << endl;
              cout << "              Instructions) " << endl;
            }
            else {
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[16] = 0b ";
```

```
                cout.unsetf(ios::left);
                cout << " (bit 16==1 indicates Support of Floating-Point"
                     << " Conditional Move" << endl;
                cout << "              Instructions) " << endl;
              }
              test_reg = reg_edx;
              break;
case 17 : if ((test_reg & 0x007E0000) == 0x00000000) {   //Test bits 17:22
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[17:22] = ";
                cout.unsetf(ios::left);
                cout << " Reserved" << endl;
              }
              test_reg = reg_edx;
              break;
case 18 : if ((test_reg & 0x00800000) == 0x00800000){  //Test bit 23
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[23] = 1b ";
                cout.unsetf(ios::left);
                cout << " (bit 23==1 indicates Support of MMX(tm)"
                     << " Technology) " << endl;
              }
              else {
                cout.width(12);
                cout.setf(ios::left);
                cout << "EDX[23] = 0b ";
                cout.unsetf(ios::left);
                cout << " (bit 23==1 indicates Support of MMX(tm)"
                     << " Technology) " << endl;
              }
              test_reg = reg_edx;
              break;
case 19 : if ((test_reg & 0x7F000000) == 0x00000000) {   //Test bits 24:30
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[24:30] = ";
              cout.unsetf(ios::left);
              cout << " Reserved" << endl;
              }
              test_reg = reg_edx;
              break;
case 20 : if ((test_reg & 0x80000000 ) == 0x80000000){//Bit 31: 3DNow!
                                                     //technology bit
              cout.width(12);
              cout.setf(ios::left);
              cout << "EDX[31] = 1b ";
              cout.unsetf(ios::left);
              cout << " (bit 31==1 indicates 3DNow! Technology)" <<endl;
          }
```

```
                        else
                        {
                           cout.width(12);
                           cout.setf(ios::left);
                           cout << "EDX[31] = 0b ";
                           cout.unsetf(ios::left);
                           cout << " (bit 31==1 indicates 3DNow! Technology)" << endl;
                        }
                        test_reg = reg_edx;
                        break;
        }
   }
   cout << "\n                    Press any key for more. " << endl;
   getch();
}
```

EXT_CPU_NAME_STR Module (extstr.cpp file)

```
#include "defines.h"
#include <iostream.h>
#include <iomanip.h>
#include <conio.h>

//ext_cpu_name_str() displays the processor name string (up to 48 characters).
//The processor name string is the name of the AMD processor.

//This function displays screen 7
void cpuid :: ext_cpu_name_str(void)
{
 unsigned long reg_eax, reg_ebx, reg_ecx, reg_edx;    //Register variables
 char idstr[48];                                      //Processor name string variable
 int func;                                            //Case statement variable
 int maxfunc = 2;                                     //Control loop variable

 clrscr();
 cout << "Function 8000_0002, 8000_0003, 8000_0004 (EAX = 80000002/3/4)" << endl;
 cout << "============================================================";
 cout << "\n\n";
 for (func = 0; func <= maxfunc; func++){
      switch (func){

        case 0 :  cout << "          Input: EAX = 80000002 " << endl;
                        cout << "              EAX = ";
                        cout.setf(ios::uppercase);

                        asm mov eax, 0x80000002 //EAX=80000002
                        asm db 0x0F, 0xA2       //CPUID opcode
                        reg_eax = _EAX;         //Store the processor name string
                        reg_ebx = _EBX;
                        reg_edx = _EDX;
                        reg_ecx = _ECX;
                        cout << setw(8) << hex << reg_eax << endl;
                        cout << "              EBX = " << setw(8) << hex
                             << reg_ebx << endl;
                        cout << "              ECX = "
                             << setw(8) << hex << reg_ecx << endl;
                        cout << "              EDX = " << setw(8) << hex
                             << reg_edx << endl;

                         _EAX = reg_eax;
                         _EBX = reg_ebx;
                         _ECX = reg_ecx;
                         _EDX = reg_edx;

                        //Get the first 12 characters of the processor name string
                        idstr[0] = _AL;
                        idstr[1] = _AH;
```

```
                    asm  ror eax,0x10
                    idstr[2] = _AL;
                    idstr[3] = _AH;
                    idstr[4] = _BL;
                    idstr[5] = _BH;
                    asm ror ebx,0x10
                    idstr[6] = _BL;
                    idstr[7] = _BH;
                    idstr[8] = _CL;
                    idstr[9] = _CH;
                    asm ror  ecx,0x10
                    idstr[10] = _CL;
                    idstr[11] = _CH;
                    idstr[12] = _DL;
                    idstr[13] = _DH;
                    asm ror edx, 0x10;
                    idstr[14] = _DL;
                    idstr[15] = _DH;
                    //idstr[16] = '\0';
                    break;
case 1 :  cout << "          Input: EAX = 80000003 " << endl;
                    cout << "              EAX = ";

                    asm mov eax, 0x80000003 //EAX = 8000_0003
                    asm db 0x0F, 0xA2       //CPUID opcode
                    reg_eax = _EAX;
                    reg_ebx = _EBX;
                    reg_edx = _EDX;
                    reg_ecx = _ECX;
                    cout << setw(8) << hex << reg_eax << endl
                         << "              EBX = " << setw(8) << hex
                         << reg_ebx << endl << "              ECX = "
                         << setw(8) << hex << reg_ecx << endl
                         << "              EDX = " << setw(8) << hex
                         << reg_edx << endl;

                     _EAX = reg_eax;
                     _EBX = reg_ebx;
                     _ECX = reg_ecx;
                     _EDX = reg_edx;
                    //Get the second 12 characters of the processor name string
                    idstr[16] = _AL;
                    idstr[17] = _AH;
                    asm  ror eax,0x10
                    idstr[18] = _AL;
                    idstr[19] = _AH;
                    idstr[20] = _BL;
                    idstr[21] = _BH;
                    asm ror ebx,0x10
                    idstr[22] = _BL;
                    idstr[23] = _BH;
```

```
                    idstr[24] = _CL;
                    idstr[25] = _CH;
                    asm ror  ecx,0x10
                    idstr[26] = _CL;
                    idstr[27] = _CH;
                    idstr[28] = _DL;
                    idstr[29] = _DH;
                    asm ror edx, 0x10;
                    idstr[30] = _DL;
                    idstr[31] = _DH;
                    break;
case 2 :  cout << "          Input: EAX = 80000004 " << endl;
                    cout << "              EAX = ";

                    asm mov eax, 0x80000004 //EAX = 8000_00004
                    asm db 0x0F, 0xA2       //CPUID opcode
                    reg_eax = _EAX;
                    reg_ebx = _EBX;
                    reg_edx = _EDX;
                    reg_ecx = _ECX;
                    cout << setw(8) << hex << reg_eax << endl
                         << "              EBX = " << setw(8) << hex
                         << reg_ebx << endl << "              ECX = "
                         << setw(8) << hex << reg_ecx << endl
                         << "              EDX = " << setw(8) << hex
                         << reg_edx << endl;
                     cout.unsetf(ios::uppercase);

                     _EAX = reg_eax;
                     _EBX = reg_ebx;
                     _ECX = reg_ecx;
                     _EDX = reg_edx;
                    //Get the less of the processor name string
                    idstr[32] = _AL;
                    idstr[33] = _AH;
                    asm  ror eax,0x10
                    idstr[34] = _AL;
                    idstr[35] = _AH;
                    idstr[36] = _BL;
                    idstr[37] = _BH;
                    asm ror ebx,0x10
                    idstr[38] = _BL;
                    idstr[39] = _BH;
                    idstr[40] = _CL;
                    idstr[41] = _CH;
                    asm ror  ecx,0x10
                    idstr[42] = _CL;
                    idstr[43] = _CH;
                    idstr[44] = _DL;
                    idstr[45] = _DH;
                    asm ror edx, 0x10;
```

```
                        idstr[46] = _DL;
                        idstr[47] = _DH;
                        idstr[48] = '\0';
                        break;
      }
 }
 cout << "\n   Processor Name String : " << idstr;
 cout << "\n\n          Press any key for more."<<"\n\n";
 getch();

}
```

EXT_CPU_CACHE_INFO Module (extcache.cpp file)

```
#include "defines.h"
#include <iostream.h>
#include <iomanip.h>
#include <conio.h>

//cpu_cache_info() provides information about the instruction TLB,
//data TLB, L1 instruction cache, and L1 data cache.

//This function displays screens 8 and 9
void cpuid::ext_cpu_cache_info(void)
{
  unsigned long reg_eax, reg_ebx, reg_ecx, reg_edx, test_reg; //Register variable
  unsigned long  bits7_0, bits15_8, bits23_16, bits31_24;     //TLB, data cache
                                                              //and L1 instruction cache
                                                              //information variable
  clrscr();
  cout << "Function 8000_0005 (EAX = 80000005)" << endl;
  cout << "=================================== " << "\n\n";
  cout << " Processor Cache Information : " << "\n\n";

  asm mov eax,0x80000005                  //EAX = 8000_0005h
  asm db 0x0F, 0xA2                       //CPUID opcode
  reg_eax = _EAX;                         //Store the EAX register
  reg_ebx = _EBX;                         //Store data and instruction TLB
  reg_edx = _EDX;                         //Store the L1 data cache
  reg_ecx = _ECX;                         //Store the L1 instruction cache

  cout.setf(ios::uppercase);
  cout << " EAX == " << setw(8) << hex << reg_eax << "  EBX == "
            << setw(8) << hex << reg_ebx << "  ECX == " << setw(8)
            << hex << reg_ecx << "  EDX == " << setw(8) << hex
            << reg_edx << "\n\n";

  test_reg = reg_ebx;                     //Data and instruction TLB
  bits7_0 = (test_reg & 0x000000ff);      //Instruction TLB entries
  test_reg = reg_ebx;
  bits15_8 = (test_reg & 0x0000ff00);     //Associativity of instruction TLB
  bits15_8 >>= 8;
  test_reg = reg_ebx;
  bits23_16 = (test_reg & 0x00ff0000);    //Data TLB entries
  bits23_16 >>= 16;
  test_reg = reg_ebx;
  bits31_24 = (test_reg & 0xff000000);    //Associativity of data TLB
  bits31_24 >>= 24;


  cout<<"\n\n";
  cout<<"       ------------------------------------------------------------ "
          <<endl;
```

```
cout<<"       |        |         Data TLB        |  Instruction TLB       |"
          << endl;
cout<<"       ------------------------------------------------------------- "
          << endl;
cout<<"       |        |Associativity| #Entries  |Associativity| #Entries |"
          << endl;
cout<<"       ------------------------------------------------------------- "
          << endl;
cout<<"       |        |Bits 31-24   |Bits 23-16 | Bits 15-8   | Bits 7-0 |"
          << endl;
cout<<"       -------------------------------------------------------------"
          << endl;
cout<<"       |  EBX   |     " << setw(2) << hex << bits31_24
          <<"      |    " << setw(2) << hex << bits23_16 <<"     |      "
          << setw(2) << dec
          << bits15_8 << "     |     " << setw(2) << hex << bits7_0 << "   |"
          << endl;
cout<<"       -------------------------------------------------------------"
          << endl;
cout<<"       Note: " << endl;
cout<<"            Full associativity is indicated by a value of 0FFh."
          <<"\n\n";
cout<< "                       Press any key for more." <<"\n\n\n";
getch();

test_reg = reg_ecx;
bits7_0 = (test_reg & 0x000000ff);      //Line size of L1 data cache
test_reg = reg_ecx;
bits15_8 = (test_reg & 0x0000ff00);     //Lines per tag of L1 data cache
bits15_8 >>= 8;
test_reg = reg_ecx;
bits23_16 = (test_reg & 0x00ff0000);    //Associativity
bits23_16 >>= 16;
test_reg = reg_ecx;
bits31_24 = (test_reg & 0xff000000);    //Size
bits31_24 >>= 24;

clrscr();
cout<< "\n\n\n";
cout<<"       ------------------------------------------------------------- "
          <<endl;
cout<<"       |        |               L1    Data   Cache                |"
          << endl;
cout<<"       ------------------------------------------------------------- "
          << endl;
cout<<"       |        |    Size     |Associa -  | Lines  per  |Line Size |"
          << endl;
cout<<"       |        |  (Kbytes)   |tivity     |      Tag    |  (bytes) |"
          << endl;
cout<<"       ------------------------------------------------------------- "
          << endl;
```

```
cout<<"       |        |Bits 31-24   |Bits 23-16 | Bits 15-8   | Bits 7-0 |"
          << endl;
cout<<"       ---------------------------------------------------------"
          << endl;
cout<<"       |  ECX   |     " << setw(2) << hex << bits31_24
          <<"      |    " << setw(2) << hex << bits23_16 <<"     |      "
          << setw(2) << dec
          << bits15_8 << "     |     " << setw(2) << hex << bits7_0 << "   |"
          << endl;
cout<<"       ---------------------------------------------------------"
          << endl;

cout<<"       Note: " << endl;
cout<<"            Full associativity is indicated by a value of 0FFh."
          <<"\n\n";
cout<< "                       Press any key for more." << endl;
getch();

test_reg = reg_edx;
bits7_0 = (test_reg & 0x000000ff);      //Line size of L1 instruction cache
test_reg = reg_edx;
bits15_8 = (test_reg & 0x0000ff00);     //Lines per tag of L1 instruction cache
bits15_8 >>= 8;
test_reg = reg_edx;
bits23_16 = (test_reg & 0x00ff0000);    //Associativity
bits23_16 >>= 16;
test_reg = reg_edx;
bits31_24 = (test_reg & 0xff000000);    //Size
bits31_24 >>= 24;

clrscr();
cout<< "\n\n";
cout<<"       ---------------------------------------------------------- "
          <<endl;
cout<<"       |        |            L1 Instruction Cache                 |"
          << endl;
cout<<"       ---------------------------------------------------------- "
          << endl;
cout<<"       |        |    Size     |Associa -  | Lines  per  |Line Size |"
          << endl;
cout<<"       |        |  (Kbytes)   |tivity     |      Tag    |  (bytes) |"
          << endl;
cout<<"       ---------------------------------------------------------- "
          << endl;
cout<<"       |        |Bits 31-24   |Bits 23-16 | Bits 15-8   | Bits 7-0 |"
          << endl;
cout<<"       ---------------------------------------------------------"
          << endl;
cout<<"       |  EDX   |     " << setw(2) << hex << bits31_24
          <<"      |    " << setw(2)<< hex << bits23_16 <<"     |      "
          << setw(2) << dec
```

```
            << bits15_8 << "     |     " << setw(2) << hex << bits7_0 << "   |"
            << endl;
  cout<<"       ------------------------------------------------------------"
            << endl;
  cout<<"       Note: " << endl;
  cout<<"            Full associativity is indicated by a value of 0FFh."
            <<endl;
  cout<<"\n\n";
  cout.unsetf(ios::uppercase);
}
```