READ THIS NOW!

- Print your name in the space provided below. For the 10:10 section code a group of '**1**' for the 12:20 section code a group of '**2**'.
- Print your name and ID number on the Opscan form; be sure to code your ID number on the Opscan form. Code **Form B** on the Opscan.
- Choose the single best answer for each question — some answers may be partially correct. If you mark more than one answer, it will be counted wrong.
- Unless a question involves determining whether given C++ code is syntactically correct, assume that it is valid. The given code has been compiled and tested, except where there are deliberate errors. Unless a question specifically deals with compiler `#include` directives, you should assume the necessary header files have been included.
- Be careful to distinguish integer values from floating point (real) values (containing a decimal point). In questions/answers which require a distinction between integer and real values, integers will be represented without a decimal point, whereas real values will have a decimal point, [1704 (integer), 1704.0 (real)].
- The answers you mark on the Opscan form will be considered your official answers.
- When you have completed the test, sign the pledge at the bottom of this page and turn in the test.
- This is a closed-book, closed-notes examination. No calculators or other electronic devices may be used during this examination. You may not discuss (in any form: written, verbal or electronic) the content of this examination with any student who has not taken it. You must return this test form when you complete the examination. Failure to adhere to any of these restrictions is an Honor Code violation.
- There are 25 questions, equally weighted. The maximum score on this test is 100 points.

Do not start the test until instructed to do so!

Print Name (Last, First) _____

Pledge: On my honor, I have neither given nor received unauthorized aid on this examination.

_____
signature

I. Pointers

Use the responses:

```
   (1) Valid                  (2)  Invalid
```

for the next 6 questions (#1 - #6). Considering each numbered question statement in the function below separately, determine whether each statement would be valid or invalid:

Assume the following function declarations:

```
void FN1(const int* const FormalParm);
void FN2(int* const FormalParm);
void FN3(const int* FormalParm);

void G(int*& IntArrayPtr) {

  int *a = IntArrayPtr;
  int *b = IntArrayPtr;
  int *c = IntArrayPtr;

  FN1(a);

  FN2(b);

  FN3(c);

}                                       // Q U E S T I O N S
                                        // -----------------
void FN1(const int* const FormalParm){
  int arr[6] = {0, -1, -2, -3, -4, -5};

  FormalParm = arr;                     //#1: (1)Valid or (2)Invalid ?

  FormalParm[0] = 6;                    //#2: (1)Valid or (2)Invalid ?
}

void FN2(int* const FormalParm) {
  int arr[6] = {0, -1, -2, -3, -4, -5};

  FormalParm = arr;                     //#3: (1)Valid or (2)Invalid ?

  FormalParm[0] = 6;                    //#4: (1)Valid or (2)Invalid ?
}


void FN3(const int* FormalParm) {
  int arr[6] = {0, -1, -2, -3, -4, -5};

  FormalParm = arr;                     //#5: (1)Valid or (2)Invalid ?

  FormalParm[0] = 6;                    //#6: (1)Valid or (2)Invalid ?
}
```

I. Pointers (continued)

#7 What value is printed by the code fragment below?

```
const int SIZE = 5;
float* r; float * f;

r = new float [SIZE];  // assume allocation starts at address 00010000

for (int i = 0; i < SIZE; i++)
      r[i] = float(i);
f = r;
f = f + 1;
cout << " f = " << f << endl;
```

(1) 00010000 (2) 00010001 (3) 00010004 (4) 00010008

(5) 0.0 (6) 1.0 (7) 2.0 (8) None of the above

Consider the following code:

```
void DelMem (int arr[],
             int deinit, int dim);

const int DIM = 5;
void main() {
int* a = new(nothrow) int[DIM];

  //use array

  DelMem( a, 0, DIM);

}
```

```
//Deallocate array memory & zero
void DelMem( int arr[],
             int deinit, int dim)
{
  //zero memory for safety
  for (int* i=arr; dim >0; i++, dim--)
      *i = deinit;       //deinitialize

  delete [] arr;         //delete array
}
```

#8 In the code above, how is the array int pointer variable `a` being passed to the `DelMem()` function?

(1) by value (2) by reference (3) by const reference
(4) as a const pointer (5) as a pointer to a const target (6) as a const pointer to a const target
(7) none of the above

#9 Unfortunately the above call to `DelMem()` does not function as intended. Select the statement below that best describes how to fix the problem.

(1) the `dim` parameter must not be decremented and used for loop control termination, a temporary local variable should be defined and used for this purpose.

(2) the integer array parameter, `a`, must be passed as a pointer to a `const` target parameter to allow the dynamic array memory to be deallocated by `delete.`

(3) the integer array parameter, `a`, must be passed as a `const` pointer parameter to prevent the `for` loop in `DelMem()` from accidentally resetting the array dimension when `dim` is decremented.

(4) the integer array parameter, `a`, must be passed as a reference pointer parameter to allow the changes made by `DelMem()` to take effect and prevent a compilation error from occurring.

(5) none of the above

I. Pointers (continued)

Assume the following declarations:

```
const int CAPACITY = 100;
int r = 0, w[CAPACITY]={0};

int* p; int* q;
```

Use the responses:

```
(1) Valid                  (2)  Invalid
```

for the next 6 questions (#10 - #15). Considering each statement below **independently**, determine whether each statement would compile (not link) without errors after the statement:

```
p = new int[CAPACITY];
```

#10
```
delete [] w;
```

#11
```
q = &p[ -1 + CAPACITY];
```

#12
```
*p = *(&w[CAPACITY - 1]);
```

#13
```
p[1] = w*2+1;
```

#14
```
p[CAPACITY-1] = w[CAPACITY-1];
```

#15
```
*(w+1) = *(p+1);
```

#16 Identify the most serious logical error that best identifies what occurs in the code fragment:

(1) Alias pointer exists
(2) Dangling pointer exists
(3) Illegal memory address reference
(4) Memory garbage exists
(5) Undefined pointer dereferenced
(6) No logical error occurs

```
char *c = new char[4];
char *d = &c[0];
delete [] c;
d[0]= 'W'; d[1]= 'X';
d[2]= 'Y'; d[3]= '\0';
```

#17 Identify the most serious logical error that best identifies what occurs in the code fragment:

(1) Alias pointer exists
(2) Dangling Reference exists
(3) Illegal memory address reference
(4) Memory garbage exists
(5) Undefined pointer dereferenced
(6) No logical error occurs

```
char *c = new char[2];
*c = 'A'; *(c+1)= '\0';
delete c;
*c = 'B';
```

II. Class Basics

Assume the following class declaration and implementation:

```
class FloorLamp {
private:
   bool  light;  //true: light is on
   int   watts;  //brightness: 0..100
public:
   FloorLamp();
   FloorLamp(bool button, int level);
   void on();
   void off();
   bool onoff();
   void dim(int delta);
   int  brightness();
};

FloorLamp:: FloorLamp() {
   light   = false; //light off
   watts   = 50;    //half intensity
}

FloorLamp:: FloorLamp(bool button,
                      int  level) {
   light = button;
   watts = level;
}
```

```
void FloorLamp::on() {
   light = true;
}

void FloorLamp::off() {
   light = false;
}

bool FloorLamp::onoff() {
   return light;
}

void FloorLamp:: dim(int delta) {
   watts += delta; //positive||negative
}

int FloorLamp:: brightness() {
   return watts;
}
```

Circle the number of the best answer to each question:

#18 How many function invocation(s), (i.e. function executions), does the following statement cause:

```
FloorLamp Lamps[10];
```

(1) 1 (2) 2 (3) 9 (4) 10

(5) 11 (6) 12 (7) 20 (8) Zero

#19 Given the object definitions at the right, which of the following object statements are valid?

```
FloorLamp  Table(true, 25), Desk;
```

(1) `bool SameLampState = ( Desk == Table );` (2) `FloorLamp Room = Table;`

(3) `Desk = Table;` (4) `Table->dim(-25);` (5) `cout << Desk;`

(6) 1 & 2 (7) 2 & 3 (8) 3 & 4

(9) 4 & 5 (10) All are valid

#20 Which of the member functions in the `FloorLamp` class should have been declared as `const` member functions?:

```
(1) FloorLamp();            (2) FloorLamp(bool button, int  level);
(3) void on();              (4) void off();   (5) bool onoff();
(6) void dim(int delta);    (7) int  brightness();
(8) 1 & 2                   (9) 3, 4 & 5      (10) 5 & 7
```

#21 Given the object definition at the right, which of the following object statements would cut power to the lamp?

```
FloorLamp Banker(true, 75);
```

(1) `Banker.light = false;`
(2) `Banker.watts = 0;`
(3) `Banker.dim(-100);`
(4) `Banker.off();`
(5) None of the above

#22 How many mutator member functions does the `FloorLamp` class declaration contain?

(1) 1 (2) 2 (3) 3
(4) 4 (5) 0 (6) None of the above

#23 Given the function definition at the right, what do the following statements accomplish:

```
bool TooHot (FloorLamp lamp) {
   return(lamp.watts > 100 );
} // TooHot
```

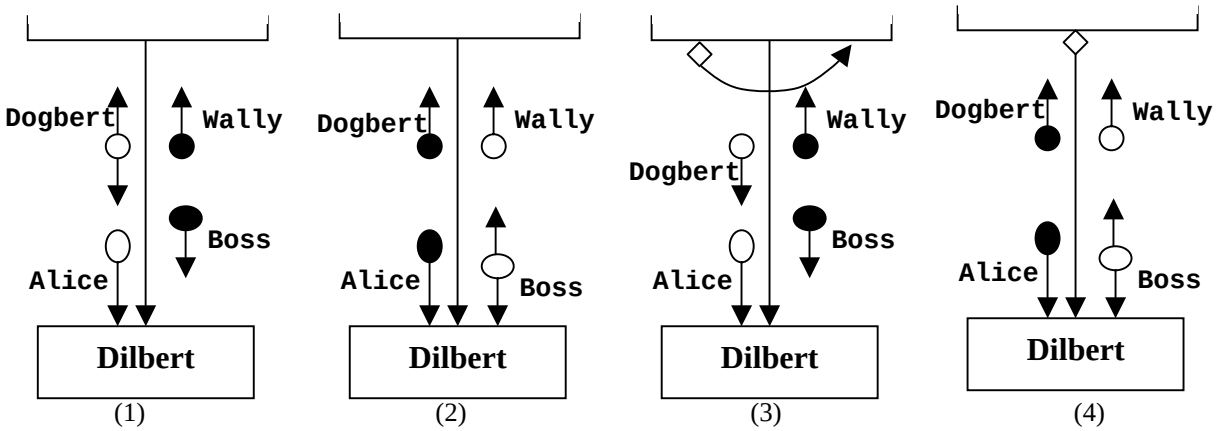
```
bool TooHot (FloorLamp lamp);

void main () {
   FloorLamp book(true, 100);
   book.dim(25);
   if (TooHot(book) )
         cout << "***Book Lamp Setting Too Hot***";
}
```

(1) causes `main()` to display a warning message.
(2) causes a execution error when the `dim()` member function is invoked.
(3) causes a compilation error.
(4) contains a logic error by setting the lamp `watts` above 100.
(5) None of these

III. Design Representation

Use the following partial Structure Chart diagrams below as answers for the next 2 questions:



(5) 1 & 2 (6) 2 & 3 (7) 3 & 4 (8) 1 & 3 (9) 2 & 4 (10) None of the above

Do not make any assumption about variables that are not shown on the chart. Given the following variable definitions:

```
int    Dogbert, Wally,
       Alice, Boss;
```

#24 Which of the above structure chart diagrams for `Dilbert()` correctly models the code segment below?

```
Dilbert(Dogbert, Wally, Alice, Boss);
if (Wally)
   //code under control of if
```

```
void Dilbert(int& Dogbert, int& Wally,
             int Alice, int  Boss) {
   if (Boss < 1)
       //code under control of if
```

#25 Which of the above structure chart diagrams for `Dilbert()` correctly models the code segment below?

```
if (Dogbert)
   Dilbert(Dogbert, Wally,
           Alice,   Boss );
```

```
void Dilbert(int& Dogbert, int& Wally,
             int Alice, int&  Boss) {
   if (Alice)
       //code under control of if
```