The following exam is pledged. All answers are to be given on the provided answer sheet. The test is closed book, closed note, and closed calculator. If you believe more than one answer is acceptable, choose the best answer. *YOU MUST HAND IN ALL COPIES OF THE TEST AND THE ANSWER SHEET.* **All questions can be assumed to compile except possibly 52-54. However, not all possible answers necessarily compile. Leaving out or misentering identification information on the answer sheet will cause a 5 point penalty.**

PART I: Multiple choice questions

1. Give the decimal value of the number 01001_2.

   (a) 1001

   (b) 5

   (c) **9**

   (d) 17

   (e) none of the above

2. Give the decimal value of the number 0374_8

   (a) 374

   (b) 252

   (c) 352

   (d) 254

   (e) none of the above

3. Give the base 2 representation of the decimal number 126.

   (a) 00001111_2

   (b) **01111110_2**

   (c) 01100010_2

   (d) 11111110_2

   (e) none of the above

4. Give the base 2 representation of the decimal number -17.

   (a) 11111111_2

   (b) 11101111_2

   (c) 10001_2

   (d) **$–10001_2$**

   (e) none of the above

5. What is the length of the literal character string `"1\t2\t2"`?

   (a) 3

   (b) **5**

   (c) 7

   (d) 9

   (e) none of the above

6. What does the following program output?

```
#include <iostream>
using namespace std;
int main () {
    cout << "We will not suffer\nalone." << endl;
    return 0;
}
```

   (a)   We will not suffernaloneendl

   (b)   We will not suffernalone.

   (c)   We will not suffer alone.

   (d)   We will not sufferalone.

   (e)   **None of the above**

7. Why do programmers comment?

   (a)   Give compiler extra instructions

   (b)   Aid readability

   (c)   To hide code for debugging purposes

   (d)   **(b) and (c)**

   (e)   none of the above

8. What statement produces the output

```
Triangle sides: 3
```

   (a)   `cout << "Triangle" << "sides:" << "3" << endl;`

   (b)   **`cout << "Triangle sides: 3" << endl;`**

   (c)   `cout << "Triangle sides:" << 3 << endl;`

   (d)   (a), (b), and (c)

   (e)   none of the above

9. What statement defines a single-precision floating point C++ constant `LIGHT_SPEED` equal to $3.0 \cdot 10^6$?

   (a)   `final float LIGHT_SPEED = 3.0e6;`

   (b)   `const double LIGHT_SPEED = 3.0e6;`

   (c)   `constant float LIGHT_SPEED = 3.0e6;`

   (d)   **`const float LIGHT_SPEED = 3.0e6;`**

   (e)   none of the above

10. What statement defines a `double` variable `area` that is initialized to the area of a rectangle with width `w` and height `h`?

   (a)   `double area = cin >> w * h;`

   (b)   `double area = w + h;`

   (c)   `double area, w, h;`

   (d)   **`double area = w * h;`**

   (e)   none of the above

11. Which choice uses parentheses that explicitly demonstrate how the following expression is evaluated?

```
8 + 5 * 6 / 4 - 2
```

(a)   (8 + (5 * (6 / 4))) - 2

(b)   **(8 + ((5 * 6) / 4)) - 2**

(c)   (((8 + 5) * 6) / 4) - 2

(d)   (8 + (5 * 6)) / (4 - 2)

(e)   none of the above

12. Evaluate the following C++ expressions.

```
13 % 3
5 / 4
5 / 4.0
```

(a)   0, 1, 1.25

(b)   **1, 1, 1.25**

(c)   1, 1.0, 1.25

(d)   1, 1.25, 1.25

(e)   none of the above

13. Evaluate the following C++ expression.

```
1.5 * 3.0 + 8 + 2 / 8
```

(a)   12

(b)   12.0

(c)   **12.5**

(d)   12.75

(e)   none of the above

14. Write a C++ expression for the mathematical expression $a^3(a+1)(a-7)$.

(a)   **a*a*a*(a+1)*(a-7)**

(b)   a^3(a+1)(a-7)

(c)   a**3(a+1)*(a-7)

(d)   (a) and (b)

(e)   none of the above

15. Write a C++ expression for the mathematical expression $\dfrac{1}{1+x^2}$.

(a)   (1+x*x)e-1

(b)   **1/(1 + x*x)**

(c)   1/(1 + 1/(x*x))

(d)   (a) and (c)

(e)   none of the above

16. Suppose water costs 0.021 cents per 100 gallons. Write a single statement that defines a single-precision floating point value `total` that is initialized to the cost in cents of buying n gallons of water.

   (a) **`float total = 0.021F * n / 100;`**

   (b) `float total = 2.1e-1 * n / 100;`

   (c) `float total = 0.021F * n / 10e-2;`

   (d) `float total = 0.021F * n * 10e+2;`

   (e) none of the above

17. Suppose `int` variables `a`, `b`, and `c` are `int` variables initialized respectively to 1, 2, and 3. What values are assigned to `e`, `f`, and `g` after the following code segment has completed.

```
int e = ++a;
int f = b++;
int g = ++c + 1;
```

   (a) e is 1, f is 2, g is 4

   (b) e is 1, f is 3, g is 5

   (c) e is 2, f is 2, g is 4

   (d) e is 2, f is 3, g is 5

   (e) **none of the above**

18. Which statement best converts a centigrade temperature to its equivalent Fahrenheit temperature, where the equation for converting a Celsius temperature to Fahrenheit is $Fahrenheit = \frac{9}{5}Celsius + 32$. You may assume that `double` variables `Fahrenheit` and `Celsius` are already defined

   (a) **`Fahrenheit = 9 * Celsius / 5 + 32;`**

   (b) `Fahrenheit = 9 / 5 * Celsius + 32;`

   (c) `Fahrenheit = 9 / 5 * (Celsius + 32);`

   (d) (a) and (b) work equally well

   (e) none of the above

19. Define a `string` variable `s` that represents the concatenation of the `string` variables `u` and `v`. You may assume that `u` and `v` have been previously defined.

   (a) `string s = u || v;`

   (b) **`string s = u + v;`**

   (c) `string s = u && v;`

   (d) `string s = u concatenate v;`

   (e) none of the above

20. Give a code segment that defines an EzWindows window with the label `"CS 101"`. The window should be 12 centimeters wide and 10 centimeters high.

   (a) `Window W = "CS 101";`

   (b) `Window W("CS 101", 12, 10);`

   (c) **`SimpleWindow W("CS 101", 12, 10);`**

   (d) `W = SimpleWindow("CS 101", 12, 10);`

   (e) none of the above

21. Define a `string` variable whose value is the empty string.

    (a) `string s;`

    (b) **`string s = "";`**

    (c) `string s = '';`

    (d) `string s = " ";`

    (e) none of the above

22. What appears in your program output window from the following code segment?.

```
string s = "1";
cout << s << endl;
```

    (a) **`1`**

    (b) `"1"`

    (c) `s`

    (d) `"s"`

    (e) none of the above

23. An abstraction is

    (a) object

    (b) **representation of the essential attributes and behaviors of a type of information**

    (c) variable

    (d) all of the above

    (e) none of the above

24. How many of bits of memory are there in a machine with 64 megawords of memory where a word consists of 4 bytes?

    (a) `4 * 64 * 1,000,000`

    (b) $4 * 64 * 2^{20}$

    (c) $8 * 4 * 64 * 2^{7}$

    (d) $\mathbf{8 * 4 * 64 * 2^{20}}$

    (e) none of the above

Questions 25–27 are concerned with the following code segment.

```
if (i == j) {
   cout << "A" << endl;
}
else if ((i % j) < 3) {
   cout << "B" << endl;
}
else if (i < (j-1)) {
   cout << "C" << endl;
}
else {
   cout << "D" << endl;
}
```

25. If `i` is 9 and `j` is 4, what is the output?

    (a)   A

    (b)   **B**

    (c)   C

    (d)   D

    (e)   none of the above

26. If `i` is 5 and `j` is 6, what is the output?

    (a)   A

    (b)   B

    (c)   C

    (d)   **D**

    (e)   none of the above

27. If `i` is 4 and `j` is 9, what is the output?

    (a)   A

    (b)   B

    (c)   **C**

    (d)   D

    (e)   none of the above

Questions 28-29 are concerned with how many times the phrase *CS101 rocks* is displayed by the following code segment.

```
int number;
while (cin >> number) {
   cout << "CS101 rocks" << endl;
}
```

28. If standard input contains

```
1
2
3
```

   then the phrase is displayed

    (a)   0 times

    (b)   1 time

    (c)   2 times

    (d)   **3 times**

    (e)   none of the above

29. If standard input contains

```
1 2 3
2
3
```

then the phrase is displayed

    (a)   0 times

    (b)   3 times

    (c)   **5 times**

    (d)   6 times

    (e)   none of the above

Questions 30-31 are concerned with how many times the phrase *Go Wahoos* is displayed by the following code segment.

```
char c;
while (cin >> c) {
    cout << "Go Wahoos" << endl;
}
```

30. If standard input contains

```
a
b
1
```

then the phrase is displayed

    (a)   0 times

    (b)   1 time

    (c)   2 times

    (d)   **3 times**

    (e)   none of the above

31. If standard input contains

```
a b c
12
```

then the phrase is displayed

    (a)   0 times

    (b)   3 times

    (c)   **5 times**

    (d)   6 times

    (e)   none of the above

32. What is the output of the following code segment?

```
int counter1 = 0;
int counter2 = 0;
int counter3 = 0;
int counter4 = 0;
int counter5 = 0;
for (int i = 0; i < 5; ++i) {
   ++counter1;
   for (int j = 0; j < 10; ++j) {
      ++counter2;
      for (int k = 0; k < 2; ++k) {
         ++counter3;
      }
      ++counter4;
   }
   ++counter5;
}
cout << counter1 << " " << counter2 << " " << counter3
     << " " << counter4 << " " << counter5;
```

(a)   5 15 17 15 5

(b)   5 50 100 100 100

(c)   5 50 150 50 5

(d)   5 50 250 50 5

(e)   **none of the above**

Questions 33-37 are concerned with completing the below code segment that computes the variance of a set of n int numbers from standard input. The segment uses the following formula for variance

$$\frac{1}{n-1}\left(\sum_{i=1}^{n} x_i^2 - n(\bar{x} \cdot \bar{x}) \right)$$

where $\bar{x}$ is the average of the data set and x_i is the ith value in the data set.

```
1.  int Sum = 0;
2.  int SumSquared = 0;
3.  for (int i = 0; i < _____ ; ++i) {
4.     cout << "Enter number: ";
5.     _____
6.     cin >> x;
7.     Sum _____ x;
8.     SumSquared = _____ + (x * x);
9.  }
10. double average = 1.0 * _____ / n;
11. double variance = (SumSquared - _____) / (n - 1);
```

33. The blank in line 3 should be replaced with

(a)   10

(b)   Sum

(c)   n - 1

(d)   **n**

(e)   none of the above

34. The blank in line 5 should be replaced with

    (a)   **`int x;`**

    (b)   `float x;`

    (c) `long x;`

    (d)   `int x << cin;`

    (e)   none of the above

35. The blank in line 7 should be replaced with

    (a)   **`+=`**

    (b)   `=+`

    (c) `=`

    (d)   `= x +`

    (e)   none of the above

36. The blank in line 10 should be replaced with

    (a)   **`Sum`**

    (b)   `SumSquared`

    (c)   `Sum*Sum`

    (d)   `SumSquared*SumSquared`

    (e)   none of the above

37. The blank in line 11 should be replaced with

    (a)   `n(average*average)`

    (b)   `n(average**2)`

    (c)   `n(average^2)`

    (d) **`n*average*average`**

    (e)   none of the above

38. A CPU coupled with a arithmetic logic unit

    (a)   Fetches, decodes and executes instructions

    (b)   Performs Boolean and arithmetic operations

    (c)   Issues input and output instructions

    (d)   **(a), (b), and (c)**

    (e)   (a) and (c)

39. In C++, what are the contents in memory of a variable that has not been initialized?

    (a)   **Its value is undetermined**

    (b)   All zeros

    (c)   All ones

    (d)   `'\0'`

    (e)   none of the above

Questions 40-43 are concerned with completing the below code segment that computes the first n numbers in the Fibonacci sequence, where n is a user-specified integer value greater than 1. The sequence starts with the following numbers: 1, 1, 2, 3, 5, 8, 13, 21. After the initial two 1s, each number in the sequence is the sum of the two previous numbers. For example, $1 + 1 = 2$, $1 + 2 = 3$, $2 + 3 = 5$, $3 + 5 = 8$, and so on.

```
1.   cout << "Enter a whole number greater than 1: ";
2.   int n;
3.   cin >> _____;
4.   if ( _____ < 2 ) {
5.        cout << "Illegal request" << endl;
6.        return 1;
7.   }
8.   else {
9.      int curr = 1;
10.     int prev = 1;
11.     cout << 1 << endl << 1 << endl;
12.     _____ (int i = 3; i < n ; ++i) {
13.        int rmbr = curr;
14.        curr = _____ ;
15.        prev = _____ ;
16.        cout << curr << endl;
17.     }
18. }
```

40. The blank in line 3 should be replaced with

    (a) 10

    (b) "n"

    (c) **n**

    (d) int n

    (e) none of the above

41. The blank in line 4 should be replaced with

    (a) 0

    (b) "n"

    (c) **n**

    (d) int n

    (e) none of the above

42. The blank in line 12 should be replaced with

    (a) For

    (b) **for**

    (c) While

    (d) while

    (e) none of the above

43. The blank in line 14 should be replaced with

> (a)   `rmbr`
>
> (b)   **`curr + prev`**
>
> (c)   `curr + n`
>
> (d)   `prev + n`
>
> (e)   none of the above

44. The blank in line 15 should be replaced with

> (a)   **`rmbr`**
>
> (b)   `curr`
>
> (c)   `prev`
>
> (d)   `n`
>
> (e)   none of the above

PART II: True/False questions. Use a for true and b for false.

45. `W.Open()` is a legal C++ identifier. **(false)**

46. `JoanneLouiseCatherineI` is a legal C++ identifier. **(true)**

47. `2BeOrNot2Be` is a legal C++ identifier. **(false)**

Questions 48–51 are concerned with the logical operator *nor*, where operator *nor* is the complement of the Boolean operator *or*; that is it the *not* of the result of an *or* operation.

48. If `P` is `true` and `Q` is `true` then `P` *nor* `Q` is `true`. **(false)**

49. If `P` is `true` and `Q` is `false` then `P` *nor* `Q` is `true`. **(false)**

50. If `P` is `false` and `Q` is `true` then `P` *nor* `Q` is `true`. **(false)**

51. If `P` is `false` and `Q` is `false` then `P` *nor* `Q` is `true`. **(true)**

52. The following segment successfully makes the iostream library available. **(false)**

```
#include <iostream>
using namespace standard;
```

53. The following segment successfully compiles. **(false)**

```
#include "rect.h"
int ApiMain() {
   RectangleShape R(10, 5, Blue);
   R.Draw();
   return 0;
}
```

54. The following statements successfully compile as part of some function `main()`. **(false)**

```
int i;
cin << i << endl;
```

55. Because a while test expression can be initially false, it is possible for the body of a while loop not to be executed. **(true)**