These are questions from a previous year's midtem exam.

Short answer questions

(1) *(30 points)* Write short answers in the boxes below.

(1-A) Write one line of code that will compute the square root of two and store it in a variable named 'root'. Assume the 'root' variable has already been declared.

(1-B) Write one line of code that will declare an array named 'weights' that can hold exactly 20 integers.

(1-C) Assume you have a string stored in a variable named 'poem'. Write one line of code that will print out the ASCII code of the 4^{th} character in the string to the console, followed by a newline. (For clarity only: The fourth character in the string has exactly three characters before it.)

(1-D) Consider these two lines of code (assume they are in `main`):

```
int length;
cout << length << endl;
```

If these statements were executed, what would you expect to be printed to the console? *Briefly* explain your reasoning.

(1-E) Briefly explain the purpose of a function contract. (I already know what it is - don't define it. I want you to describe reasons *why* we use them.)

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(1-F) The following statements are variable declarations and initializations. Assume that they are part of a larger program. Evaluate each expression in the table below and give the resulting type and value of each expression. (The first one is done for you.) Be careful – make sure to evaluate each sub-expression properly, and use the correct literal form for each type of resulting value.

```
char    code = 'A';
int     offset = 20;
int     span = 6;
double  pi = 3.1415;
string  customer = "Jane";
bool    isDone = true;
```

Expression	Value	Type
`offset / span`	3	int
`offset % span`		
`offset <= span`		
`offset + (int) pi`		
`span + pi`		
`(char) (code + 1)`		
`customer.length() < 4 || isDone`		

(1-G) True or false? A pointer is a number that specifies the address in memory (memory location) of some stored value (usually a variable). ☐

(1-H) True or false? A `break` statement and a `return` statement are equivalent ways of terminating a loop. ☐

(1-I) True or false? Declaring a `struct` above your functions creates a global variable array with named fields in it. ☐

(1-J) True or false? An Arduino chip contains a circuit that will protect an output from damage in case you accidentally connect an output directly to ground, and then turn on (set to high) that output. ☐

(1-K) There are always at least two functions in a typical Arduino program. One of them runs only once, and the other one is repeated over and over afterwards. Give their names:

Runs once: ☐ Repeats forever: ☐

(1-L) Write one line of code that would cause an Arduino program to wait exactly one-half second before proceeding.

☐

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Programming problems

You are to write C/C++ statements and programs to complete the following three problems. Write neatly!

For each program your code will be graded for choice of algorithms, correctness, conciseness, proper syntax, proper formatting, and readability. If needed, partial credit will be awarded for incomplete solutions that are well-written, organized, and that show an understanding of C/C++ programming techniques.

(2) *(20 points)* Write a function header, statements, and a single loop to complete this function that computes triangular numbers. (A triangular number N is just the sum of the numbers 1...N.) Do not simplify the computation - use a loop.

A typical solution will be 6 to 10 lines of code. The function contract is given below:

```
\* Computes and returns the nth triangular number.
 *
 * Parameters:
 *   int n - some number N
 *
 * Returns:
 *   int - the sum of the numbers from 1...N inclusive
 *
 *\
```

These are questions from a previous year's midtem exam.

(3) *(20 points)* Write a sequence of statements that will read through the integers in a file and then display the largest even integer found in the file.

- Assume your statements are within `main`. (Do not write `main` or include statements.)
- Assume the file is named 'data.txt', that it exists, that it only contains integers, and that the first one is an even integer.
- Use the console for the output. Do not get any input from the user.
- Keep your solution simple. Do not use arrays - they are too much work for this problem.
- Output the result on one line and make your output message a complete user-friendly sentence.

A typical solution will be 10 to 15 lines of text.

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(4) *(30 points)* Use `if` statements, expressions, local variables, input statements, and output statements to complete a program so that it satisfies the following description.

Write a complete program (every necessary line) that computes and displays the total phone bill for a cell phone customer. Your program should prompt the user and input numbers from the user as follows:

- Input an integer that corresponds to the number of minutes of talk time used.
- Input an integer that corresponds to the number of text messages sent.

Your program should then use the user's input and calculate and display the total phone bill using these rules:

- Every phone is charged a $10.00 fee.
- Add a charge of $0.10 for every minute of talk time, and an additional charge of $0.05 for every minute of talk time after the first 100 minutes. (The first 100 minutes are $0.10 a minute, all minutes above this are $0.15 a minute.)

  Example: If 110 minutes of talk time were used, the charge for talk time would be $0.10 times 100, plus $0.15 times 10, for a total fee of $11.50
- Add a charge of $0.25 for every text message.
- No phone bill can exceed $69.95. If the phone bill exceeds this amount, the phone bill should become $69.95 instead.

  Example: If 300 minutes of talk time were used, and 300 text messages were sent, the bill would come to $125. Because no phone bill can exceed $69.95, the phone bill is reduced to $69.95.

Use the console for input and output, and format your output in a user-friendly manner. You do not need to format the phone bill amount.

A typical solution will be 15 to 25 lines of code. This page and the next page are reserved for your solution. Plan ahead to avoid scribbles, insertions, or erasures. (Correctness and neatness *will both count for points*).