Deverto C++ Developer Test

Please send your solutions as a single file. If you have created multiple files (e.g. source code), please

- start each file name with the ordinal number of the question it belongs to (e.g. `1-solution.cpp`),
- create and send a `zip` archive of all your files.

Language basics

1. Virtual methods

What are virtual methods, what can be achieved with them, what happens if the keyword is omitted?

2. Memory

Where can a variable (basic type or object) be stored in memory? Give an example for each allocation type.

3. Smart pointer

What are “smart pointers”, what problem do they address, and how do they work?

Algorithms

Please write your solution in C++.

4. Fifth powers

Surprisingly there are only three numbers that can be written as the sum of fourth powers of their digits:

$$1634 = 1^4 + 6^4 + 3^4 + 4^4$$

$$8208 = 8^4 + 2^4 + 0^4 + 8^4$$

$$9474 = 9^4 + 4^4 + 7^4 + 4^4$$

As $1 = 1^4$ is not a sum it is not included.
The sum of these numbers is $1634 + 8208 + 9474 = 19316$.
Write a program which calculates the sum of all the numbers that can be written as the sum of fifth powers of their digits.

Multi threading

5. Threads

What is the difference between a multi threaded and multi process application?

6. Deadlock

What is a deadlock? How can it happen? How can it be avoided?

7. Thread safe queue

Please provide a high level C++ implementation for a thread safe message queue with multiple producer thread and a single consumer thread. Impelement the accessor methods (Push, Pop), concentrate on locking and thread waiting mechanism, use high level data structures (e.g. an STL queue), gloss over other details.
Producer thread:

```
while (true)
{
     QueueEntry ent = CreateANewEntry();
     queue.Push(ent);
}
```

Consumer thread:

```
while (true)
{
    QueueEntry ent = queue.Pop();
    ProcessQueueEntry(ent);
}
```