

1.1 ./csharp/Platform.RegularExpressions.Transformer.CSharpToCpp/CSharpToCppTransformer.cs

```

1  using System;
2  using System.Collections.Generic;
3  using System.Linq;
4  using System.Text.RegularExpressions;
5
6  #pragma warning disable CS1591 // Missing XML comment for publicly visible type or member
7
8  namespace Platform.RegularExpressions.Transformer.CSharpToCpp
9  {
10     public class CSharpToCppTransformer : TextTransformer
11     {
12         public static readonly IList

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58 //
59 (new Regex(@"r?\n[^\n]+bool operator !=\(((?<type>[^\n]+) (?<left>[a-zA-Z0-9]+),
    ↳ \k<type> (?<right>[a-zA-Z0-9]+)\) => !\((\k<left>|\k<right>) ==
    ↳ (\k<left>|\k<right>)\);"), "", 10),
60 // public override bool Equals(object obj) => obj is Range<T> range ? Equals(range)
    ↳ : false;
61 //
62 (new Regex(@"r?\n[^\n]+override bool Equals\((System\.)?[Oo]bject
    ↳ (?<this>[a-zA-Z0-9]+)\) => \k<this> is [^\n]+ (?<other>[a-zA-Z0-9]+) \?
    ↳ Equals\(\k<other>\) : false;"), "", 10),
63 // out TProduct
64 // TProduct
65 (new Regex(@"(?<before><|, )(in|out)
    ↳ (?<typeParameter>[a-zA-Z0-9]+)(?<after>>|,))"),
    ↳ "${before}${typeParameter}${after}", 10),
66 // public ...
67 // public: ...
68 (new Regex(@"(?<newLineAndIndent>r?\n?[
    ↳ \t]*) (?<before>[^\{\\(\\r\\n]*) (?<access>private|protected|public) [
    ↳ \t]+(?! [^\{\\(\\r\\n]*(interface|class|struct) [^\{\\(\\r\\n)*[\\(\\r\\n)])"),
    ↳ "${newLineAndIndent}${access}: ${before}", 0),
69 // public: static bool CollectExceptions { get; set; }
70 // public: inline static bool CollectExceptions;
71 (new Regex(@"(?<access>(private|protected|public): ) (?<before>(static )? [^\r\\n]+
    ↳ ) (?<name>[a-zA-Z0-9]+) { [^;]* (?<=\\W) get; [^;]* (?<=\\W) set; [^;]* }"),
    ↳ "${access}inline ${before}${name};", 0),
72 // public abstract class
73 // class
74 (new Regex(@"((public|protected|private|internal|abstract|static)
    ↳ )*(?<category>interface|class|struct)", "${category}", 0),
75 //class GenericCollectionMethodsBase<TElement> {
76 // template <typename TElement> class GenericCollectionMethodsBase {
77 (new Regex(@"(?<before>r?\n) (?<indent>[ \t]*) (?<type>class|struct)
    ↳ (?<typeName>[a-zA-Z0-9]+)< (?<typeParameters>[a-zA-Z0-9
    ↳ ,]+)> (?<typeDefinitionEnding>[^\{]+){", "${before}${indent}template <typename
    ↳ ...> ${type} ${typeName};" + Environment.NewLine + "${indent}template <typename
    ↳ ${typeParameters}> ${type}
    ↳ ${typeName}<${typeParameters}>${typeDefinitionEnding}{", 0),
78 // static void
    ↳ TestMultipleCreationsAndDeletions<TElement>(SizedBinaryTreeMethodsBase<TElement>
    ↳ tree, TElement* root)
79 // template<typename T> static void
    ↳ TestMultipleCreationsAndDeletions<TElement>(SizedBinaryTreeMethodsBase<TElement>
    ↳ tree, TElement* root)
80 (new Regex(@"static ([a-zA-Z0-9]+) ([a-zA-Z0-9]+)<([a-zA-Z0-9]+)>\((( [^\r\\n]+)\)"),
    ↳ "template <typename $3> static $1 $2($4)", 0),
81 // interface IFactory<out TProduct> {
82 // template <typename...> class IFactory; \ntemplate <typename TProduct> class
    ↳ IFactory<TProduct>
83 (new Regex(@"(?<before>r?\n) (?<indent>[ \t]*) interface
    ↳ (?<interface>[a-zA-Z0-9]+)< (?<typeParameters>[a-zA-Z0-9
    ↳ ,]+)> (?<typeDefinitionEnding>[^\{]+){", "${before}${indent}template <typename
    ↳ ...> class ${interface};" + Environment.NewLine + "${indent}template <typename
    ↳ ${typeParameters}> class
    ↳ ${interface}<${typeParameters}>${typeDefinitionEnding}{", 0),
    ↳ "public:", 0),
84 // template <typename TObject, TProperty, TValue>
85 // template <typename TObject, typename TProperty, typename TValue>
86 (new Regex(@"(?<before>template <((, )?typename [a-zA-Z0-9]+)+,
    ↳ ) (?<typeParameter>[a-zA-Z0-9]+) (?<after>(,|>))"), "${before}typename
    ↳ ${typeParameter}${after}", 10),
87 // Insert markers
88 // private: static void BuildExceptionString(this StringBuilder sb, Exception
    ↳ exception, int level)
89 // /*~extensionMethod~BuildExceptionString~*/private: static void
    ↳ BuildExceptionString(this StringBuilder sb, Exception exception, int level)
90 (new Regex(@"private: static [^\r\\n]+ (?<name>[a-zA-Z0-9]+)\(this [^\r\\n]+\)",
    ↳ "/*~extensionMethod~${name}~*/$0", 0),
91 // Move all markers to the beginning of the file.
92 (new Regex(@"\A(?<before>[^\r\\n]+\r?\n(.|\n)+) (?<marker>\/\*~extensionMethod~(?<name>
    ↳ [a-zA-Z0-9]+)~\*/)", "${marker}${before}",
    ↳ 10),
93 // /*~extensionMethod~BuildExceptionString~*/...sb.BuildExceptionString(exception.In_
    ↳ nerException, level +
    ↳ 1);

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94 // /*~extensionMethod~BuildExceptionString~*/...BuildExceptionString(sb,
95   ↳ exception.InnerException, level + 1);
96 (new Regex(@"(?<before>/\/*~extensionMethod~(?<name>[a-zA-Z0-9]+)~\*/(.|\n)+\W)(?<var_
97   ↳ iable>[_a-zA-Z0-9]+)\. \k<name>\("), "${before}${name}${{variable}}, ",
98   ↳ 50),
99 // Remove markers
100 // /*~extensionMethod~BuildExceptionString~*/
101 //
102 (new Regex(@"\/*~extensionMethod~[a-zA-Z0-9]+~\*/"), "", 0),
103 // (this
104 // (
105 (new Regex(@"\((this ", "(", 0),
106 // public: static readonly EnsureAlwaysExtensionRoot Always = new
107   ↳ EnsureAlwaysExtensionRoot();
108 // public: inline static EnsureAlwaysExtensionRoot Always;
109 (new Regex(@"(?<access>(private|protected|public): )?static readonly
110   ↳ (?<type>[a-zA-Z0-9]+(<[a-zA-Z0-9]+>?)) (?<name>[a-zA-Z0-9_]+) = new
111   ↳ \k<type>\(\);", "${access}inline static ${type} ${name};", 0),
112 // public: static readonly Range<int> SByte = new
113   ↳ Range<int>(std::numeric_limits<int>::min(), std::numeric_limits<int>::max());
114 // public: inline static Range<int> SByte =
115   ↳ Range<int>(std::numeric_limits<int>::min(), std::numeric_limits<int>::max());
116 (new Regex(@"(?<access>(private|protected|public): )?static readonly
117   ↳ (?<type>[a-zA-Z0-9]+(<[a-zA-Z0-9]+>?)) (?<name>[a-zA-Z0-9_]+) = new
118   ↳ \k<type>\(\((?<arguments>[^\n]+)\);", "${access}inline static ${type} ${name} =
119   ↳ ${type}${{arguments}};", 0),
120 // public: static readonly string ExceptionContentsSeparator = "---";
121 // public: inline static const char* ExceptionContentsSeparator = "---";
122 (new Regex(@"(?<access>(private|protected|public): )?(const|static readonly) string
123   ↳ (?<name>[a-zA-Z0-9_]+) = ""(?<string>(\\"|\\r\\n))+"";", "${access}inline
124   ↳ static const char* ${name} = \"${string}\";", 0),
125 // private: const int MaxPath = 92;
126 // private: inline static const int MaxPath = 92;
127 (new Regex(@"(?<access>(private|protected|public): )?(const|static readonly)
128   ↳ (?<type>[a-zA-Z0-9]+) (?<name>[_a-zA-Z0-9]+) = (?<value>[^\r\n]+);",
129   ↳ "${access}inline static const ${type} ${name} = ${value};", 0),
130 // ArgumentNotNull(EnsureAlwaysExtensionRoot root, TArgument argument) where
131   ↳ TArgument : class
132 // ArgumentNotNull(EnsureAlwaysExtensionRoot root, TArgument* argument)
133 (new Regex(@"(?<before> [a-zA-Z]+\\((([a-zA-Z *,]+, |)) (?<type>[a-zA-Z]+) (?<after>(\\
134   ↳ [a-zA-Z *,]+)\\))) [ \r\n]+where \k<type> : class", "${before}${type}*${after}",
135   ↳ 0),
136 // protected: abstract TElement GetFirst();
137 // protected: virtual TElement GetFirst() = 0;
138 (new Regex(@"(?<access>(private|protected|public): )?abstract
139   ↳ (?<method>[^\r\n]+);", "${access}virtual ${method} = 0;", 0),
140 // TElement GetFirst();
141 // virtual TElement GetFirst() = 0;
142 (new Regex(@"([ \r\n]+[ ]+)((?!return)[a-zA-Z0-9]+ [a-zA-Z0-9]+\\([^\r\n]*\\))([
143   ↳ ]*[ \r\n]+)", "$1virtual $2 = 0$3", 1),
144 // protected: readonly TreeElement[] _elements;
145 // protected: TreeElement _elements[N];
146 (new Regex(@"(?<access>(private|protected|public): )?readonly
147   ↳ (?<type>[a-zA-Z<0-9]+)([ \[\]]+) (?<name>[_a-zA-Z0-9]+);", "${access}${type}
148   ↳ ${name}[N];", 0),
149 // protected: readonly TElement Zero;
150 // protected: TElement Zero;
151 (new Regex(@"(?<access>(private|protected|public): )?readonly
152   ↳ (?<type>[a-zA-Z<0-9]+) (?<name>[_a-zA-Z0-9]+);", "${access}${type} ${name};",
153   ↳ 0),
154 // internal
155 //
156 (new Regex(@"(\W)internal\s+", "$1", 0),
157 // static void NotImplementedException(ThrowExtensionRoot root) => throw new
158   ↳ NotImplementedException();
159 // static void NotImplementedException(ThrowExtensionRoot root) { return throw new
160   ↳ NotImplementedException(); }
161 (new Regex(@"(^s+)(private|protected|public)?(: )?(template \<[^>\r\n]+\> )?(static
162   ↳ )?(override )?([a-zA-Z0-9]+
163   ↳ )([a-zA-Z0-9]+)\\(((\\[ \r\n]*))\s+=>\s+throw([^\r\n]+);",
164   ↳ "$1$2$3$4$5$6$7$8($9) { throw$10; }", 0),
165 // SizeBalancedTree(int capacity) => a = b;
166 // SizeBalancedTree(int capacity) { a = b; }
167 (new Regex(@"(^s+)(private|protected|public)?(: )?(template \<[^>\r\n]+\> )?(static
168   ↳ )?(override )?(void )?([a-zA-Z0-9]+)\\(((\\[ \r\n]*))\s+=>\s+([^\r\n]+);",
169   ↳ "$1$2$3$4$5$6$7$8($9) { $10; }", 0),

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139 // int SizeBalancedTree(int capacity) => a;
140 // int SizeBalancedTree(int capacity) { return a; }
141 (new Regex(@"(^\\s+)(private|protected|public)?(?: )?(template \\<[^\\r\\n]+\\> )?(static
→ )?(override)?([a-zA-Z0-9]+
→ )([a-zA-Z0-9]+)\\(((\\r\\n)*)\\)\\s+=>\\s+([~;\\r\\n]+);"), "$1$2$3$4$5$6$7$8($9) {
→ return $10; }", 0),
142 // () => Integer<TElement>.Zero,
143 // () { return Integer<TElement>.Zero; },
144 (new Regex(@"\\(\\)\\s+=>\\s+(?<expression>[^() ,;\\r\\n]+(\\(((?<parenthesis>\\()|(?<-parent_
→ hesis>)\\)|\\(\\)\\s+=>\\s+([~;\\r\\n]+)?\\))?(?<after>,|\\);)"), "()" { return
→ ${expression}; }${after}", 0),
145 // => Integer<TElement>.Zero;
146 // { return Integer<TElement>.Zero; }
147 (new Regex(@"\\(\\)\\s+=>\\s+([~;\\r\\n]+?);"), ") { return $1; }", 0),
148 // () { return avlTree.Count; }
149 // [&]() -> auto { return avlTree.Count; }
150 (new Regex(@"(?<before>, |\\(\\)\\(\\) { return (?<expression>[~;\\r\\n]+); }"),
→ "${before}[&]() -> auto { return ${expression}; }", 0),
151 // Count => GetSizeOrZero(Root);
152 // GetCount() { return GetSizeOrZero(Root); }
153 (new Regex(@"(\\W)([A-Z][a-zA-Z]+)\\s+=>\\s+([~;\\r\\n]+);"), "$1Get$2() { return $3; }",
→ 0),
154 // ArgumentInRange(const char* message) { const char* messageBuilder() { return
→ message; }
155 // ArgumentInRange(const char* message) { auto messageBuilder = [&]() -> const char*
→ { return message; };
156 (new Regex(@"(?<before>\\W[_a-zA-Z0-9]+\\(((\\r\\n)*)[\\s\\n]*{[\\s\\n]*([~}]|\\n)*?(\\r?\\n)
→ ?[ \\t]*)?(?<returnType>[_a-zA-Z0-9*:] +[_a-zA-Z0-9*:] *)
→ (?<methodName>[_a-zA-Z0-9]+)\\(((?<arguments>[^\\r\\n]*)\\)\\s*{(?<body>("[^""\\n]+""|
→ [~}]|\\n)+?)}"), "${before}auto ${methodName} = [&]() -> ${returnType}
→ {${body}};", 10),
157 // Func<TElement> treeCount
158 // std::function<TElement()> treeCount
159 (new Regex(@"Func<([a-zA-Z0-9]+)> ([a-zA-Z0-9]+)"), "std::function<$1()> $2", 0),
160 // Action<TElement> free
161 // std::function<void(TElement)> free
162 (new Regex(@"Action<([a-zA-Z0-9]+)> ([a-zA-Z0-9]+)"), "std::function<void($1)> $2",
→ 0),
163 // Predicate<TArgument> predicate
164 // std::function<bool(TArgument)> predicate
165 (new Regex(@"Predicate<([a-zA-Z0-9]+)> ([a-zA-Z0-9]+)"), "std::function<bool($1)>
→ $2", 0),
166 // var
167 // auto
168 (new Regex(@"(\\W)var(\\W)"), "$1auto$2", 0),
169 // unchecked
170 //
171 (new Regex(@"[\\r\\n]{2}\\s*?unchecked\\s*?$"), "", 0),
172 // throw new InvalidOperationException
173 // throw std::runtime_error
174 (new Regex(@"throw new (InvalidOperationException|Exception)", "throw
→ std::runtime_error", 0),
175 // void RaiseExceptionIgnoredEvent(Exception exception)
176 // void RaiseExceptionIgnoredEvent(const std::exception& exception)
177 (new Regex(@"(\\(| ) (System\\.Exception|Exception) (|\\))"), "$1const
→ std::exception&$3", 0),
178 // EventHandler<Exception>
179 // EventHandler<std::exception>
180 (new Regex(@"(\\W) (System\\.Exception|Exception) (\\W)"), "$1std::exception$3", 0),
181 // override void PrintNode(TElement node, StringBuilder sb, int level)
182 // void PrintNode(TElement node, StringBuilder sb, int level) override
183 (new Regex(@"override ([a-zA-Z0-9 \\*+]*)\\(((\\r\\n)*)[~}\\n]+?)"), "$1$2 override", 0),
184 // return (range.Minimum, range.Maximum)
185 // return {range.Minimum, range.Maximum}
186 (new Regex(@"(?<before>return\\s*)\\(((?<values>[^\\r\\n]+)\\) (?!\\() (?<after>\\W)"),
→ "${before}${values}${after}", 0),
187 // string
188 // const char*
189 (new Regex(@"(\\W)string(\\W)"), "$1const char*$2", 0),
190 // System.ValueTuple
191 // std::tuple
192 (new Regex(@"(?<before>\\W) (System\\.)?ValueTuple(?:\\s*=|\\() (?<after>\\W)"),
→ "${before}std::tuple${after}", 0),
193 // sbyte
194 // std::int8_t

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195 (new Regex(@"(?<before>\W)((System\.)?SB|sb)yte(?:\s*=\|()\ (?<after>\W)"),
196     ↳ "${before}std::int8_t${after}", 0),
197 // short
198 // std::int16_t
199 (new Regex(@"(?<before>\W)((System\.)?Int16|short)(?:\s*=\|()\ (?<after>\W)"),
200     ↳ "${before}std::int16_t${after}", 0),
201 // int
202 // std::int32_t
203 (new Regex(@"(?<before>\W)((System\.)?I|i)nt(32)?(?:\s*=\|()\ (?<after>\W)"),
204     ↳ "${before}std::int32_t${after}", 0),
205 // long
206 // std::int64_t
207 (new Regex(@"(?<before>\W)((System\.)?Int64|long)(?:\s*=\|()\ (?<after>\W)"),
208     ↳ "${before}std::int64_t${after}", 0),
209 // byte
210 // std::uint8_t
211 (new Regex(@"(?<before>\W)((System\.)?Byte|byte)(?:\s*=\|()\ (?<after>\W)"),
212     ↳ "${before}std::uint8_t${after}", 0),
213 // ushort
214 // std::uint16_t
215 (new Regex(@"(?<before>\W)((System\.)?UInt16|ushort)(?:\s*=\|()\ (?<after>\W)"),
216     ↳ "${before}std::uint16_t${after}", 0),
217 // uint
218 // std::uint32_t
219 (new Regex(@"(?<before>\W)((System\.)?UI|ui)nt(32)?(?:\s*=\|()\ (?<after>\W)"),
220     ↳ "${before}std::uint32_t${after}", 0),
221 // ulong
222 // std::uint64_t
223 (new Regex(@"(?<before>\W)((System\.)?UInt64|ulong)(?:\s*=\|()\ (?<after>\W)"),
224     ↳ "${before}std::uint64_t${after}", 0),
225 //char*[] args
226 // char* args[]
227 (new Regex(@"([_a-zA-Z0-9:\*]?)\[\] ([_a-zA-Z0-9]+)"), "$1 $2[]", 0),
228 // @object
229 // object
230 (new Regex(@"@([_a-zA-Z0-9]+)"), "$1", 0),
231 // std::int32_t.MinValue
232 // std::numeric_limits<float>::min()
233 (new Regex(@"(?<before>\W)(?<type>std::[_a-z0-9_]+\)\.MinValue(?:<after>\W)"),
234     ↳ "${before}std::numeric_limits<${type}>::min()${after}", 0),
235 // float.MinValue
236 // std::numeric_limits<float>::lowest()
237 (new Regex(@"(?<before>\W)(?<type>float|double)\.MinValue(?:<after>\W)"),
238     ↳ "${before}std::numeric_limits<${type}>::lowest()${after}", 0),
239 // double.MaxValue
240 // std::numeric_limits<float>::max()
241 (new Regex(@"(?<before>\W)(?<type>std::[_a-z0-9_]+\|float|double)\.MaxValue(?:<after>\W)"),
242     ↳ "${before}std::numeric_limits<${type}>::max()${after}",
243     ↳ 0),
244 // using Platform.Numbers;
245 //
246 (new Regex(@"([\r\n]{2}|~)\s*?using [_a-zA-Z0-9]+;\s*?${")", "", 0),
247 // struct TreeElement { }
248 // struct TreeElement { };
249 (new Regex(@"(struct|class) ([_a-zA-Z0-9]+)(\s+){([\sa-zA-Z0-9;:_]+?)}([\^;])", "$1
250     ↳ $2$3{$4};$5", 0),
251 // class Program { }
252 // class Program { };
253 (new Regex(@"(struct|class) ([_a-zA-Z0-9]+)[^\r\n]*([\r\n]+(?<indentLevel>[\t
254     ↳ ]*)?)\{([\S\s]+?[\r\n]+\k<indentLevel>)\}([\^;]|$)", "$1 $2$3{$4};$5", 0),
255 // class SizedBinaryTreeMethodsBase : GenericCollectionMethodsBase
256 // class SizedBinaryTreeMethodsBase : public GenericCollectionMethodsBase
257 (new Regex(@"(struct|class) ([_a-zA-Z0-9]+)(<[_a-zA-Z0-9 ,]+>)? : ([_a-zA-Z0-9]+)",
258     ↳ "$1 $2$3 : public $4", 0),
259 // class IProperty : ISetter<TValue, TObject>, IProvider<TValue, TObject>
260 // class IProperty : public ISetter<TValue, TObject>, public IProvider<TValue,
261     ↳ TObject>
262 (new Regex(@"(?<before>(struct|class) [_a-zA-Z0-9]+ : ((public
263     ↳ [_a-zA-Z0-9]+(<[_a-zA-Z0-9 ,]+>)?,
264     ↳ )+)?(?<inheritedType>(?!public) [_a-zA-Z0-9]+(<[_a-zA-Z0-9 ,]+>)?)(?<after>(,
265     ↳ [_a-zA-Z0-9]+(?>)|[\r\n]+))", "${before}public ${inheritedType}${after}", 10),
266 // Insert scope borders.
267 // ref TElement root
268 // ~!root!~ref TEElement root
269 (new Regex(@"(?<definition>(?!= \|()\ (ref [_a-zA-Z0-9]+|[_a-zA-Z0-9]+(?<!ref))
270     ↳ (?<variable>[_a-zA-Z0-9]+)(?=\|, \| =)")), "~!${variable}!~${definition}", 0),

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251 // Inside the scope of ~!root!~ replace:
252 // root
253 // *root
254 (new Regex(@"(?<definition>~!(?<pointer>[a-zA-Z0-9]+)!~ref [a-zA-Z0-9]+
    ↳ \k<pointer>(=?\)|,| =)) (?<before>(((?!~\k<pointer>!~)(.|\\n))*?) (?<prefix>(\W
    ↳ |\\())\k<pointer>( ?<suffix>( |\\)|;|,))"),
    ↳ "$${definition}${before}${prefix}*${pointer}${suffix}", 70),
255 // Remove scope borders.
256 // ~!root!~
257 //
258 (new Regex(@"~!(?<pointer>[a-zA-Z0-9]+)!~"), "", 5),
259 // ref auto root = ref
260 // ref auto root =
261 (new Regex(@"ref ([a-zA-Z0-9]+) ([a-zA-Z0-9]+) = ref(\W)"), "$1* $2 =$3", 0),
262 // *root = ref left;
263 // root = left;
264 (new Regex(@"~*([a-zA-Z0-9]+) = ref ([a-zA-Z0-9]+)(\W)"), "$1 = $2$3", 0),
265 // (ref left)
266 // (left)
267 (new Regex(@"\\(ref ([a-zA-Z0-9]+)(\\)|\\(|,))"), "($1$2", 0),
268 // ref TElement
269 // TElement*
270 (new Regex(@"( |\\()ref ([a-zA-Z0-9]+) "), "$1$2*", 0),
271 // ref sizeBalancedTree.Root
272 // &sizeBalancedTree->Root
273 (new Regex(@"ref ([a-zA-Z0-9]+)\\.([a-zA-Z0-9\\*]+)"), "&$1->$2", 0),
274 // ref GetElement(node).Right
275 // &GetElement(node)->Right
276 (new Regex(@"ref ([a-zA-Z0-9]+)\\((([a-zA-Z0-9\\*]+)\\)\\.([a-zA-Z0-9]+)"),
    ↳ "&$1($2)->$3", 0),
277 // GetElement(node).Right
278 // GetElement(node)->Right
279 (new Regex(@"([a-zA-Z0-9]+)\\((([a-zA-Z0-9\\*]+)\\)\\.([a-zA-Z0-9]+)"), "$1($2)->$3", 0),
280 // [Fact]npublic: static void SizeBalancedTreeMultipleAttachAndDetachTest()
281 // public: TEST_METHOD(SizeBalancedTreeMultipleAttachAndDetachTest)
282 (new Regex(@"\\[Fact\\] \\s\\n\\n+(public: )?(static )?void ([a-zA-Z0-9]+)\\(\\)"), "public:
    ↳ TEST_METHOD($3)", 0),
283 // class TreesTests
284 // TEST_CLASS(TreesTests)
285 (new Regex(@"class ([a-zA-Z0-9]+)Tests"), "TEST_CLASS($1)", 0),
286 // Assert.Equal
287 // Assert::AreEqual
288 (new Regex(@"(Assert)\\.Equal"), "$1::AreEqual", 0),
289 // Assert.Throws
290 // Assert::ExpectException
291 (new Regex(@"(Assert)\\.Throws"), "$1::ExpectException", 0),
292 // $"Argument {argumentName} is null."
293 // std::string("Argument
    ↳ ").append(Platform::Converters::To<std::string>(argumentName)).append(" is
    ↳ null.").data()
294 (new Regex(@"\\$""(?<left>\\\\"""| [^""\\r\\n])* ){(?<expression>[_a-zA-Z0-9]+)}(?<right>\\)
    ↳ \\\\"""| [^""\\r\\n])* """,
    ↳ "std::string($\"${left}\").append(Platform::Converters::To<std::string>(${expres
    ↳ sion})).append(\"${right}\").data()",
    ↳ 10),
295 // $"
296 // "
297 (new Regex(@"\\$"""), "\\\"", 0),
298 // std::string(std::string(" ").append(Platform::Converters::To<std::string>(Minimum)
    ↳ )).append(",
    ↳ ").data()).append(Platform::Converters::To<std::string>(Maximum)).append(" ").da
    ↳ ta()
299 // std::string(" ").append(Platform::Converters::To<std::string>(Minimum)).append(",
    ↳ ").append(Platform::Converters::To<std::string>(Maximum)).append(" ").data()
300 (new Regex(@"std::string\\((?<begin>std::string\\(\\\\"""| [^""\\r\\n])* \\)\\.append\\((Platf
    ↳ orm::Converters::To<std::string>\\( [^\\n\\n]+ \\) | [^\\n\\n]+ \\) \\) \\)\\.data\\(\\) \\)\\.append",
    ↳ 10),
301 // Console.WriteLine("...")
302 // printf("...\\n")
303 (new Regex(@"Console\\.WriteLine\\(\\( [^""\\r\\n]+ \\) ""\\)"), "printf(\"$1\\n\\n\")", 0),
304 // TElement Root;
305 // TElement Root = 0;
306 (new Regex(@"\\r?\\n[\\t ]+(private|protected|public)?(
    ↳ )?(?<[a-zA-Z0-9:_]+(?<return>)) ([_a-zA-Z0-9]+);"), "$1$2$3$4 $5 = 0;", 0),
307 // TreeElement _elements[N];
308 // TreeElement _elements[N] = { {0} };

```

```

309 (new Regex(@"(\\r?\\n[\\t ]+)(private|protected|public)?(: )?([a-zA-Z0-9]+)
    ↳ ([_a-zA-Z0-9]+)\\[([_a-zA-Z0-9]+)\\];") , "$1$2$3$4 $5[$6] = { {0} };" , 0) ,
310 // auto path = new TElement[MaxPath];
311 // TElement path[MaxPath] = { {0} };
312 (new Regex(@"(\\r?\\n[\\t ]+)[a-zA-Z0-9]+ ([a-zA-Z0-9]+) = new
    ↳ ([_a-zA-Z0-9]+)\\[([_a-zA-Z0-9]+)\\];") , "$1$3 $2[$4] = { {0} };" , 0) ,
313 // bool Equals(Range<T> other) { ... }
314 // bool operator ==(const Key &other) const { ... }
315 (new Regex(@"(?<before>\\r?\\n[\\n]+bool )Equals\\((?<type>[\\n]+)
    ↳ (?<variable>[a-zA-Z0-9]+)\\)(?<after>(\\s|\\n)*{") , "${before}operator ==(const
    ↳ ${type} &${variable}) const${after}" , 0) ,
316 // Insert scope borders.
317 // class Range { ... public: override const char* ToString() { return ...; }
318 // class Range { /*~Range<T>~/ ... public: override const char* ToString() { return
    ↳ ...; } }
319 (new Regex(@"(?<classDeclarationBegin>\\r?\\n(?<indent>[\\t ]*)template <typename
    ↳ (?<typeParameter>[\\<>\\n]+> (struct|class)
    ↳ (?<type>[a-zA-Z0-9]+<\\k<typeParameter>>) (\\s*:\\s*[\\^\\n]+)?[\\t ]*(\\r?\\n)?[\\t
    ↳ ]*(?<middle>((?!class|struct)\\.\\n)+?) (?<toStringDeclaration>(?<access>(private|
    ↳ |protected|public): )override const char* ToString\\(\\))" ,
    ↳ "${classDeclarationBegin}/*~${type}~/${middle}${toStringDeclaration}" , 0) ,
320 // Inside the scope of ~!Range!~ replace:
321 // public: override const char* ToString() { return ...; }
322 // public: operator std::string() const { return ...; }\\n\\npublic: friend
    ↳ std::ostream & operator <<(std::ostream &out, const A &obj) { return out <<
    ↳ (std::string)obj; } }
323 (new Regex(@"(?<scope>/\\*~(?<type>[_a-zA-Z0-9<>:]+)~\\*/)(?<separator>\\.|\\n)(?<before>
    ↳ ((?!/\\*~\\k<type>~\\*/)(\\.|\\n))*?) (?<toStringDeclaration>\\r?\\n(?<indent>[
    ↳ \\t ]*) (?<access>(private|protected|public): )override const char* ToString\\(\\)
    ↳ (?<toStringMethodBody>{[\\^\\n]+})" , "${scope}${separator}${before}" +
    ↳ Environment.NewLine + "${indent}${access}operator std::string() const
    ↳ ${toStringMethodBody}" + Environment.NewLine + Environment.NewLine +
    ↳ "${indent}${access}friend std::ostream & operator <<(std::ostream &out, const
    ↳ ${type} &obj) { return out << (std::string)obj; }" , 0) ,
324 // Remove scope borders.
325 // /*~Range~/
326 //
327 (new Regex(@"/*~[_a-zA-Z0-9<>:]+~\\*/" , "" , 0) ,
328 // private: inline static ConcurrentBag<std::exception> _exceptionsBag;
329 // private: inline static std::mutex _exceptionsBag_mutex; \\n\\n private: inline
    ↳ static std::vector<std::exception> _exceptionsBag;
330 (new Regex(@"(?<begin>\\r?\\n(?<indent>[\\t ]+)) (?<access>(private|protected|public):
    ↳ )?inline static ConcurrentBag<(?<argumentType>[\\^;\\r\\n]+)>
    ↳ (?<name>[_a-zA-Z0-9]+);" , "${begin}private: inline static std::mutex
    ↳ ${name}_mutex;" + Environment.NewLine + Environment.NewLine +
    ↳ "${indent}${access}inline static std::vector<${argumentType}> ${name};" , 0) ,
331 // public: static IReadonlyCollection<std::exception> GetCollectedExceptions() {
    ↳ return _exceptionsBag; }
332 // public: static std::vector<std::exception> GetCollectedExceptions() { return
    ↳ std::vector<std::exception>(_exceptionsBag); }
333 (new Regex(@"(?<access>(private|protected|public): )?static
    ↳ IReadonlyCollection<(?<argumentType>[\\^;\\r\\n]+)> (?<methodName>[_a-zA-Z0-9]+)\\(\\)
    ↳ { return (?<fieldName>[_a-zA-Z0-9]+); }" , "${access}static
    ↳ std::vector<${argumentType}> ${methodName}() { return
    ↳ std::vector<${argumentType}>(${fieldName}); }" , 0) ,
334 // public: static event EventHandler<std::exception> ExceptionIgnored =
    ↳ OnExceptionIgnored; ... };
335 // ... public: static inline Platform::Delegates::MulticastDelegate<void(void*,
    ↳ const std::exception&> ExceptionIgnored = OnExceptionIgnored; };
336 (new Regex(@"(?<begin>\\r?\\n(\\r?\\n)?(?<halfIndent>[
    ↳ \\t ]+\\k<halfIndent>)(?<access>(private|protected|public): )?static event
    ↳ EventHandler<(?<argumentType>[\\^;\\r\\n]+)> (?<name>[_a-zA-Z0-9]+) = (?<defaultDele
    ↳ gate>[_a-zA-Z0-9]+); (?<middle>(\\.|\\n)+?) (?<end>\\r?\\n\\k<halfIndent>};)" ,
    ↳ "${middle}" + Environment.NewLine + Environment.NewLine +
    ↳ "${halfIndent}${halfIndent}${access}static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const ${argumentType}&)>
    ↳ ${name} = ${defaultDelegate};${end}" , 0) ,
337 // Insert scope borders.
338 // class IgnoredExceptions { ... private: inline static std::vector<std::exception>
    ↳ _exceptionsBag;
339 // class IgnoredExceptions { /*~_exceptionsBag~/ ... private: inline static
    ↳ std::vector<std::exception> _exceptionsBag;

```



```

340 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)class [^{\r\n}+\r\n[\t
    ↳ ]*(?<middle>((?!class)\.|\n)+?)(?<vectorFieldDeclaration>(?(access>(private|pro
    ↳ tected|public): )inline static std::vector<(?(argumentType>[^;\r\n]+)>
    ↳ (?(fieldName>[_a-zA-Z0-9]+));)"),
    ↳ "${classDeclarationBegin}/*~${fieldName}~/${middle}${vectorFieldDeclaration}",
    ↳ 0),
341 // Inside the scope of ~!_exceptionsBag!~ replace:
342 // _exceptionsBag.Add(exception);
343 // _exceptionsBag.push_back(exception);
344 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*)(?<separator>.\s)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*)(.|\n))*?)\k<fieldName>\.Add"),
    ↳ "${scope}${separator}${before}${fieldName}.push_back", 10),
345 // Remove scope borders.
346 // /*~_exceptionsBag~*/
347 //
348 (new Regex(@"/\s*~[_a-zA-Z0-9]+~\s*/"), "", 0),
349 // Insert scope borders.
350 // class IgnoredExceptions { ... private: static std::mutex _exceptionsBag_mutex;
351 // class IgnoredExceptions {/*~_exceptionsBag~*/ ... private: static std::mutex
    ↳ _exceptionsBag_mutex;
352 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)class [^{\r\n}+\r\n[\t
    ↳ ]*(?<middle>((?!class)\.|\n)+?)(?<mutexDeclaration>private: inline static
    ↳ std::mutex (?(fieldName>[_a-zA-Z0-9]+) mutex;)",
    ↳ "${classDeclarationBegin}/*~${fieldName}~/${middle}${mutexDeclaration}", 0),
353 // Inside the scope of ~!_exceptionsBag!~ replace:
354 // return std::vector<std::exception>(_exceptionsBag);
355 // std::lock_guard<std::mutex> guard(_exceptionsBag_mutex); return
    ↳ std::vector<std::exception>(_exceptionsBag);
356 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*)(?<separator>.\s)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*)(.|\n))*?)\{?(?<after>((?!lock_guard)[^{};\r\n])*\k<f
    ↳ ieldName>[^;}\r\n]*;)", "${scope}${separator}${before}{
    ↳ std::lock_guard<std::mutex> guard(${fieldName}_mutex);${after}", 10),
357 // Inside the scope of ~!_exceptionsBag!~ replace:
358 // _exceptionsBag.Add(exception);
359 // std::lock_guard<std::mutex> guard(_exceptionsBag_mutex); \r\n
    ↳ _exceptionsBag.Add(exception);
360 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*)(?<separator>.\s)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*)(.|\n))*?)\{?(?<after>((?!lock_guard)([^\s;]|\\n))*?\r
    ↳ ?\n(?<indent>[\t ]*)\k<fieldName>[^;}\r\n]*;)",
    ↳ "${scope}${separator}${before}{
    ↳ " + Environment.NewLine +
    ↳ "${indent}std::lock_guard<std::mutex> guard(${fieldName}_mutex);${after}", 10),
361 // Remove scope borders.
362 // /*~_exceptionsBag~*/
363 //
364 (new Regex(@"/\s*~[_a-zA-Z0-9]+~\s*/"), "", 0),
365 // Insert scope borders.
366 // class IgnoredExceptions { ... public: static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const std::exception&)>
    ↳ ExceptionIgnored = OnExceptionIgnored;
367 // class IgnoredExceptions {/*~ExceptionIgnored~*/ ... public: static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const std::exception&)>
    ↳ ExceptionIgnored = OnExceptionIgnored;
368 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)class [^{\r\n}+\r\n[\t
    ↳ ]*(?<middle>((?!class)\.|\n)+?)(?<eventDeclaration>(?(access>(private|protected|
    ↳ public): )static inline
    ↳ Platform::Delegates::MulticastDelegate<(?(argumentType>[^;\r\n]+)>
    ↳ (?(name>[_a-zA-Z0-9]+) = (?(defaultDelegate>[_a-zA-Z0-9]+));)"),
    ↳ "${classDeclarationBegin}/*~${name}~/${middle}${eventDeclaration}", 0),
369 // Inside the scope of ~!ExceptionIgnored!~ replace:
370 // ExceptionIgnored.Invoke(NULL, exception);
371 // ExceptionIgnored(NULL, exception);
372 (new Regex(@"(?<scope>/\s*(?<eventName>[_a-zA-Z0-9]+)~\s*)(?<separator>.\s)(?<before>
    ↳ >((?!/\s*\k<eventName>~\s*)(.|\n))*?)\k<eventName>\.Invoke"),
    ↳ "${scope}${separator}${before}${eventName}", 10),
373 // Remove scope borders.
374 // /*~ExceptionIgnored~*/
375 //
376 (new Regex(@"/\s*~[_a-zA-Z0-9]+~\s*/"), "", 0),
377 // Insert scope borders.
378 // auto added = new StringBuilder();
379 // /*~sb~*/std::string added;
380 (new Regex(@"(auto|(System\.Text\.)?StringBuilder) (?(variable>[_a-zA-Z0-9]+) = new
    ↳ (System\.Text\.)?StringBuilder\\(\\);)", "/*~${variable}~*/std::string
    ↳ ${variable};", 0),
381 // static void Indent(StringBuilder sb, int level)
382 // static void Indent(/*~sb~*/StringBuilder sb, int level)

```



```

383 (new Regex(@"(?<start>, |\) (System\Text\.)?StringBuilder
    ↳ (?<variable>[a-zA-Z0-9]+)(?<end>, |\)") , "${start}/*~${variable}~/std::string&
    ↳ ${variable}${end}", 0),
384 // Inside the scope of ~!added!~ replace:
385 // sb.ToString()
386 // sb.data()
387 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.ToString\\("),
    ↳ "${scope}${separator}${before}${variable}.data()", 10),
388 // sb.AppendLine(argument)
389 // sb.append(Platform::Converters::To<std::string>(argument)).append(1, '\\n')
390 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.AppendLine\\((?<argument>[^\|\\n], \\
    ↳ r\\n)+\\)"),
    ↳ "${scope}${separator}${before}${variable}.append(Platform::Converters::To<std::s
    ↳ tring>(${argument}))".append(1, '\\n')",
    ↳ 10),
391 // sb.Append('\\t', level);
392 // sb.append(level, '\\t');
393 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.Append\\('(?<character>[^\|\\r\\n]
    ↳ +)', (?<count>[^\|\\n], \\r\\n)+\\)"),
    ↳ "${scope}${separator}${before}${variable}.append(${count}, '${character}')" , 10),
394 // sb.Append(argument)
395 // sb.append(Platform::Converters::To<std::string>(argument))
396 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.Append\\((?<argument>[^\|\\n], \\r\\n
    ↳ +)\\)"),
    ↳ "${scope}${separator}${before}${variable}.append(Platform::Converters::To<std::s
    ↳ tring>(${argument}))",
    ↳ 10),
397 // Remove scope borders.
398 // /*~sb~*/
399 //
400 (new Regex(@"/*~[a-zA-Z0-9]+~\*/") , "", 0),
401 // Insert scope borders.
402 // auto added = new HashSet<TElement>();
403 // ~!added!~std::unordered_set<TElement> added;
404 (new Regex(@"auto (?<variable>[a-zA-Z0-9]+) = new
    ↳ HashSet<(?<element>[a-zA-Z0-9]+)>\\(\\)");
    ↳ "~!${variable}!~std::unordered_set<${element}> ${variable};", 0),
405 // Inside the scope of ~!added!~ replace:
406 // added.Add(node)
407 // added.insert(node)
408 (new Regex(@"(?<scope>~!(?<variable>[a-zA-Z0-9]+)!~)(?<separator>.\|\\n)(?<before>((?<
    ↳ !~!\k<variable>!~)(.\|\\n))*?)\k<variable>\.Add\\((?<argument>[a-zA-Z0-9]+)\\)"),
    ↳ "${scope}${separator}${before}${variable}.insert(${argument})", 10),
409 // Inside the scope of ~!added!~ replace:
410 // added.Remove(node)
411 // added.erase(node)
412 (new Regex(@"(?<scope>~!(?<variable>[a-zA-Z0-9]+)!~)(?<separator>.\|\\n)(?<before>((?<
    ↳ !~!\k<variable>!~)(.\|\\n))*?)\k<variable>\.Remove\\((?<argument>[a-zA-Z0-9]+)\\)"),
    ↳ "${scope}${separator}${before}${variable}.erase(${argument})", 10),
413 // if (added.insert(node)) {
414 // if (!added.contains(node)) { added.insert(node);
415 (new Regex(@"if \\((?<variable>[a-zA-Z0-9]+)\\.insert\\((?<argument>[a-zA-Z0-9]+)\\)\\)(?
    ↳ <separator>[\\t ]*[\\r\\n]+)(?<indent>[\\t ]*){") , "if
    ↳ (!${variable}.contains(${argument})) ${separator}${indent}{ " +
    ↳ Environment.NewLine + "${indent}    ${variable}.insert(${argument});", 0),
416 // Remove scope borders.
417 // ~!added!~
418 //
419 (new Regex(@"~![a-zA-Z0-9]+!~") , "", 5),
420 // Insert scope borders.
421 // auto random = new System.Random(0);
422 // std::srand(0);
423 (new Regex(@"[a-zA-Z0-9\\.]+ ([a-zA-Z0-9]+) = new
    ↳ (System\\.)?Random\\((([a-zA-Z0-9]+)\\)");
    ↳ "~!$!~std::srand($3);", 0),
424 // Inside the scope of ~!random!~ replace:
425 // random.Next(1, N)
426 // (std::rand() % N) + 1
427 (new Regex(@"(?<scope>~!(?<variable>[a-zA-Z0-9]+)!~)(?<separator>.\|\\n)(?<before>((?<
    ↳ !~!\k<variable>!~)(.\|\\n))*?)\k<variable>\.Next\\((?<from>[a-zA-Z0-9]+),
    ↳ (?<to>[a-zA-Z0-9]+)\\)"),
    ↳ "${scope}${separator}${before}{std::rand() % ${to}) +
    ↳ ${from}", 10),
428 // Remove scope borders.

```

```

429 // ~!random!~
430 //
431 (new Regex(@"~![a-zA-Z0-9]+!~"), "", 5),
432 // Insert method body scope starts.
433 // void PrintNodes(TElement node, StringBuilder sb, int level) {
434 // void PrintNodes(TElement node, StringBuilder sb, int level) { /*method-start*/
435 (new Regex(@"(?<start>\r?\n[\t ]+)(?<prefix>((private|protected|public): )?(virtual
    ↳ )?[a-zA-Z0-9:_]+
    ↳ )?(?<method>[a-zA-Z][a-zA-Z0-9]*)\(((?<arguments>[^\)]*)\)(?<override>(
    ↳ override)?)(?<separator>[ \t\r\n]*)\{(?<end>[~])\)", "${start}${prefix}${method}
    ↳ (${arguments})${override}${separator}{ /*method-start*/${end}",
    ↳ 0),
436 // Insert method body scope ends.
437 // { /*method-start*/...}
438 // { /*method-start*/... /*method-end*/}
439 (new Regex(@"\{ /*method-start*/ (?<body>((?<bracket>\{) | (?<-bracket>\}) | [^\{\}]*)) +
    ↳ \}", "{ /*method-start*/ ${body} /*method-end*/}",
    ↳ 0),
440 // Inside method bodies replace:
441 // GetFirst(
442 // this->GetFirst(
443 // (new Regex(@"(?<separator>(\(| |([\W]) |return ))(?<!(->|\*
    ↳ ))(?<method>(?!sizeof)[a-zA-Z0-9]+)\(((?!\\) \{)"),
    ↳ "${separator}this->${method}(", 1),
444 (new Regex(@"(?<scope>\/\*method-start\*/)(?<before>((?<!\/*method-end\*/)(\.|\\n))*?) (
    ↳ ?<separator>[\W] (?<!(?:\.|->)) (?<method>(?!sizeof)[a-zA-Z0-9]+)\(((?!\\)
    ↳ \{) (?<after>(\.|\\n)*?) (?<scopeEnd>\/\*method-end\*/)"),
    ↳ "${scope}${before}${separator}this->${method}(${after}${scopeEnd}", 100),
445 // Remove scope borders.
446 // /*method-start*/
447 //
448 (new Regex(@"\/\*method-(start|end)\*/"), "", 0),
449 // Insert scope borders.
450 // const std::exception& ex
451 // const std::exception& ex/*~ex~*/
452 (new Regex(@"(?<before>\\(| )(?<variableDefinition>(const )?(std::)?exception&?
    ↳ (?<variable>[_a-zA-Z0-9]+)) (?<after>\\W)"),
    ↳ "${before}${variableDefinition}/*~${variable}~*/${after}", 0),
453 // Inside the scope of ~!ex!~ replace:
454 // ex.Message
455 // ex.what()
456 (new Regex(@"(?<scope>\/\*~(?<variable>[_a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ >((?<!\/*~\k<variable>~\*/)(\.|\\n))*?) (Platform::Converters::To<std::string>\\(\k<
    ↳ variable>\\.Message\\) | \k<variable>\\.Message)"),
    ↳ "${scope}${separator}${before}${variable}.what()", 10),
457 // Remove scope borders.
458 // /*~ex~*/
459 //
460 (new Regex(@"\/\*~[_a-zA-Z0-9]+~\*/"), "", 0),
461 // throw new ArgumentNullException(argumentName, message);
462 // throw std::invalid_argument(std::string("Argument
    ↳ ").append(argumentName).append(" is null: ").append(message).append("."));
463 (new Regex(@"throw new
    ↳ ArgumentNullException\\((?<argument>[a-zA-Z]*[Aa]rgument[a-zA-Z]*),
    ↳ (?<message>[a-zA-Z]*[Mm]essage[a-zA-Z]*\\(\\)?\\);", "throw
    ↳ std::invalid_argument(std::string(\"Argument \").append(${argument}).append(\"
    ↳ is null: \").append(${message}).append(\".\"));", 0),
464 // throw new ArgumentException(message, argumentName);
465 // throw std::invalid_argument(std::string("Invalid ").append(argumentName).append("
    ↳ argument: ").append(message).append("."));
466 (new Regex(@"throw new
    ↳ ArgumentException\\((?<message>[a-zA-Z]*[Mm]essage[a-zA-Z]*\\(\\)?),
    ↳ (?<argument>[a-zA-Z]*[Aa]rgument[a-zA-Z]*\\);", "throw
    ↳ std::invalid_argument(std::string(\"Invalid \").append(${argument}).append(\"
    ↳ argument: \").append(${message}).append(\".\"));", 0),
467 // throw new ArgumentOutOfRangeException(argumentName, argumentValue,
    ↳ messageBuilder());
468 // throw std::invalid_argument(std::string("Value
    ↳ [").append(Platform::Converters::To<std::string>(argumentValue)).append("] of
    ↳ argument [").append(argumentName).append("] is out of range:
    ↳ ").append(messageBuilder()).append("."));

```

```

(new Regex(@"throw new ArgumentOutOfRangeException\(((?<argument>[a-zA-Z]*[Aa]rgument
[a-zA-Z]*([Nn]ame[a-zA-Z]*)?)
→ (?<argumentValue>[a-zA-Z]*[Aa]rgument[a-zA-Z]*([Vv]alue[a-zA-Z]*)?)
→ (?<message>[a-zA-Z]*[Mm]essage[a-zA-Z]*(\(\(\)?\)\);)", "throw
→ std::invalid_argument(std::string(\"Value
→ [ \").append(Platform::Converters::To<std::string>({argumentValue})).append(\"]
→ of argument [ \").append({argument}).append(\"] is out of range:
→ \").append({message}).append(\".\");", 0),
// throw new NotSupportedException();
// throw std::logic_error("Not supported exception.");
(new Regex(@"throw new NotSupportedException\(\);)", "throw std::logic_error(\"Not
→ supported exception.\");", 0),
// throw new NotImplementedException();
// throw std::logic_error("Not implemented exception.");
(new Regex(@"throw new NotImplementedException\(\);)", "throw std::logic_error(\"Not
→ implemented exception.\");", 0),
// Insert scope borders.
// const std::string& message
// const std::string& message/*~message~/
(new Regex(@"(?<before>\(| )(?<variableDefinition>(const )?(std::)?string&?|char\*)
→ (?<variable>[_a-zA-Z0-9]+)(?<after>\W)",
→ "${before}${variableDefinition}/*~${variable}~/${after}", 0),
// Inside the scope of /*~message~/ replace:
// Platform::Converters::To<std::string>(message)
// message
(new Regex(@"(?<scope>\/\*~(?<variable>[_a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
→ >((?!\/\*~\k<variable>~\*/)(.\|\\n))*?)Platform::Converters::To<std::string>\(\k<v
→ ariable>\)", "${scope}${separator}${before}${variable}",
→ 10),
// Remove scope borders.
// /*~ex~/
//
(new Regex(@"\/\*~[_a-zA-Z0-9]+~\*/", "", 0),
// Insert scope borders.
// std::tuple<T, T> tuple
// std::tuple<T, T> tuple/*~tuple~/
(new Regex(@"(?<before>\(| )(?<variableDefinition>(const )?(std::)?tuple<[^\n]+>&?
→ (?<variable>[_a-zA-Z0-9]+)(?<after>\W)",
→ "${before}${variableDefinition}/*~${variable}~/${after}", 0),
// Inside the scope of ~!ex!~ replace:
// tuple.Item1
// std::get<1-1>(tuple)
(new Regex(@"(?<scope>\/\*~(?<variable>[_a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
→ >((?!\/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.Item(?<itemNumber>\d+)(?<afte
→ r>\W)",
→ "${scope}${separator}${before}std::get<${itemNumber}-1>({variable})${after}",
→ 10),
// Remove scope borders.
// /*~ex~/
//
(new Regex(@"\/\*~[_a-zA-Z0-9]+~\*/", "", 0),
// Insert scope borders.
// class Range<T> {
// class Range<T> {/*~type~Range<T>~/
(new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)template <typename
→ (?<typeParameter>[^\n]+> (struct|class)
→ (?<type>[a-zA-Z0-9]+<\k<typeParameter>>)(\s*:\s*[^\n]+)?[\t ]*(\r?\n)?[\t
→ ]*\*)", "${classDeclarationBegin}/*~type~${type}~/", 0),
// Inside the scope of /*~type~Range<T>~/ insert inner scope and replace:
// public: static implicit operator std::tuple<T, T>(Range<T> range)
// public: operator std::tuple<T, T>() const {/*~variable~Range<T>~/
(new Regex(@"(?<scope>\/\*~type~(?<type>[^\n\*]+)~\*/)(?<separator>.\|\\n)(?<before>((
→ ??!\/\*~type~\k<type>~\*/)(.\|\\n))*?) (?<access>(private|protected|public): )static
→ implicit operator (?<targetType>[^\(\n\+)]((?<argumentDeclaration>\k<type>
→ (?<variable>[a-zA-Z0-9]+))\)(?<after>\s*\n?\s*\{)",
→ "${scope}${separator}${before}${access}operator ${targetType}()
→ const${after}/*~variable~${variable}~/", 10),
// Inside the scope of /*~type~Range<T>~/ replace:
// public: static implicit operator Range<T>(std::tuple<T, T> tuple) { return new
→ Range<T>(std::get<1-1>(tuple), std::get<2-1>(tuple)); }
// public: Range(std::tuple<T, T> tuple) : Range(std::get<1-1>(tuple),
→ std::get<2-1>(tuple)) { }
```

```

511 (new Regex(@"(?<scope>/\~*type~(?<type>(?(typeName>[_a-zA-Z0-9]+)[^~\n\*]*)~\*/)(?(separator>.|\\n)(?(before>((?!/\~*type~\k<type>~\*/)(.|\\n))*)?(?<access>(private|
    ↪ protected|public): )static implicit operator
    ↪ \k<type>\(((?<arguments>[~{}\\n]+)\\)(\\s|\\n)*{(\\s|\\n)*return (new
    ↪ )?<k<type>\(((?<passedArguments>[~\\n]+)\\);(\\s|\\n)*}"),
    ↪ "${scope}${separator}${before}${access}${typeName}(${arguments}) :
    ↪ ${typeName}(${passedArguments}) { }", 10),
512 // Inside the scope of /*~variable~range~*/ replace:
513 // range.Minimum
514 // this->Minimum
515 (new Regex(@"(?<scope>{/\~*variable~(?<variable>[^~\\n]+)~\*/)(?(separator>.|\\n)(?(before>(?<beforeExpression>(?(bracket>{)|(?(<-bracket>})|[^{}]|\\n)*)?\k<variable>\\.
    ↪ (?(field>[_a-zA-Z0-9]+)(?<after>(,|;|\\n|\\)))(?(afterExpression>(?(bracket>{)|(?(<-bracket>})|[^{}]|\\n)*)?)"),
    ↪ "${scope}${separator}${before}this->${field}${after}", 10),
516 // Remove scope borders.
517 // /*~ex~*/
518 //
519 (new Regex(@"/*~[^~\\n]+~[^~\\n]+~\*/", "", 0),
520 }.Cast<ISubstitutionRule>().ToList();
521
522 public static readonly IList<ISubstitutionRule> LastStage = new List<SubstitutionRule>
523 {
524     // ICounter<int, int> c1;
525     // ICounter<int, int>* c1;
526     (new Regex(@"(?<abstractType>I[A-Z][a-zA-Z0-9]+(<[~>\\r\\n]+>)?)
    ↪ (?(variable>[_a-zA-Z0-9]+)(?<after> = null)?;"), "${abstractType}*
    ↪ ${variable}${after};", 0),
527     // (expression)
528     // expression
529     (new Regex(@"(\\(|)\\((([a-zA-Z0-9_\\*:]*)\\(|;|\\n|\\))"), "$1$2$3", 0),
530     // (method(expression))
531     // method(expression)
532     (new Regex(@"(?<firstSeparator>(\\(|
    ↪ ))\\(((?<method>[a-zA-Z0-9_\\*:]*)\\(((?<expression>(?(parenthesis>(\\(|(?(<-parent
    ↪ hesis>\\)|[a-zA-Z0-9_\\*:]*)\\(|(?(parenthesis>(?!))\\)|\\n)\\))\\))\\))\\))\\))", "${firstSeparator}${method}${expression}${lastSeparator}", 0),
533     // .append(".")
534     // .append(1, '.');
535     (new Regex(@"\\.append\\(\"([~\\\"\\\\]|\\\\[~\\\"\\\\])\"\\)\", ".append(1, '$1')", 0),
536     // return ref _elements[node];
537     // return &elements[node];
538     (new Regex(@"return ref ([a-zA-Z0-9]+)\\([([a-zA-Z0-9\\*]+)\\];"), "return &$1[$2];",
    ↪ 0),
539     // null
540     // nullptr
541     (new Regex(@"(?<before>\\r?\\n[~\"\\r\\n]*(\"(\\\\\"|~\"\\r\\n))*\"[~\"\\r\\n]*)(?<=\\W)null
    ↪ (?(after>\\W)", "${before}nullptr${after}",
    ↪ 10),
542     // default
543     // 0
544     (new Regex(@"(?<before>\\r?\\n[~\"\\r\\n]*(\"(\\\\\"|~\"\\r\\n))*\"[~\"\\r\\n]*)(?<=\\W)defa
    ↪ ult(?(after>\\W)", "${before}0${after}",
    ↪ 10),
545     // object x
546     // void *x
547     (new Regex(@"(?<before>\\r?\\n[~\"\\r\\n]*(\"(\\\\\"|~\"\\r\\n))*\"[~\"\\r\\n]*)(?<=\\W)([O|
    ↪ o]bject|System\\.Object) (?(after>\\w)", "${before}void *${after}",
    ↪ 10),
548     // <object>
549     // <void*>
550     (new Regex(@"(?<before>\\r?\\n[~\"\\r\\n]*(\"(\\\\\"|~\"\\r\\n))*\"[~\"\\r\\n]*)(?<=\\W)(?!
    ↪ \\w)([O|o]bject|System\\.Object) (?(after>\\W)", "${before}void*${after}",
    ↪ 10),
551     // ArgumentException
552     // std::invalid_argument
553     (new Regex(@"(?<before>\\r?\\n[~\"\\r\\n]*(\"(\\\\\"|~\"\\r\\n))*\"[~\"\\r\\n]*)(?<=\\W)(Sys
    ↪ tem\\.)?ArgumentException (?(after>\\W)",
    ↪ "${before}std::invalid_argument${after}", 10),
554     // template <typename T> struct Range : IEquatable<Range<T>>
555     // template <typename T> struct Range {
556     (new Regex(@"(?<before>template <typename (?(typeParameter>[~\\n]+> (struct|class)
    ↪ (?(type>[a-zA-Z0-9]+<[~\\n]+>)) : (public
    ↪ )?IEquatable<\k<type>>(?(after>(\\s|\\n)*{)"), "${before}${after}", 0),
557     // #region Always
558     //

```


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