

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

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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=]=?)\s*0(?<after>\D)" ,
58             ↪ "${before}${left} ${comparison} ${right}${after}", 50),
59             // Remove markers
60             // private static readonly Comparer<T> _comparer =
61             ↪ Comparer<T>.Default; /*~_comparer~/
62             //
63             (new Regex(@"\r?\n[^\n]+\/*~[a-zA-Z0-9_]+\~*/") , "", 10),
64             // Comparer<TArgument>.Default.Compare(maximumArgument, minimumArgument) < 0
65             // maximumArgument < minimumArgument
66             (new Regex(@"Comparer<[^\n]+\>\.Default\.Compare\(\s*(?<first>[^\n]+\),\s*(?<second>
67             ↪ >[^\n]+\)\s*)\s*(?<comparison>[<>=]=?)\s*0(?<after>\D)" , "${first}
68             ↪ ${comparison} ${second}${after}", 0),
69             // public static bool operator ==(Range<T> left, Range<T> right) =>
70             ↪ left.Equals(right);
71             //
72             (new Regex(@"\r?\n[^\n]+\bool operator ==\(((?<type>[^\n]+\) (?<left>[a-zA-Z0-9_]+\),
73             ↪ \k<type> (?<right>[a-zA-Z0-9_]+\)\) \s*>
74             ↪ (\k<left>|\k<right>)\.Equals\((\k<left>|\k<right>)\);)" , "", 10),
75             // public static bool operator !=(Range<T> left, Range<T> right) => !(left == right);

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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}${after}", 10),
66 // public ...
67 // public: ...
68 (new Regex(@"(?<newLineAndIndent>r?\n?[
    ↳ \t]*) (?<before>[^\{\\(\r\n)*) (?<access>private|protected|public) [ \t]+(?![^\{\\(\r\n)
    ↳ \n]*((?<=\\s)|\\W) (interface|class|struct) (\\W) [^\{\\(\r\n)*[\\{\\(\r\n)]")",
    ↳ "${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}>${typeDefinitionEnding}{", 0),
    ↳ "public:", 0),
84 // template <typename T> TProperty, TValue>
85 // template <typename T> TProperty, TProperty, TProperty, TProperty>
86 (new Regex(@"(?<before>template <((, )?typename [a-zA-Z0-9]+)+,
    ↳ ) (?<typeParameter>[a-zA-Z0-9]+) (?<after>(,|>))", "${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 std::string 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 std::string ${name} = \"${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>\\)|[~();\r\n]*?)?)?[~();\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 $3; }",
→ 0),
154 // ArgumentInRange(string message) { string messageBuilder() { return message; }
155 // ArgumentInRange(string message) { auto messageBuilder = [&]() -> string { return
→ message; };
156 (new Regex(@"(?<before>\\W[_a-zA-Z0-9]+\\(((^\\)\n)*\\)[\\s\\n]*{[\\s\\n]*([~{}]|\\n)*?(\\r?\\n)
→ ?[ \\t]*)(?<returnType>[_a-zA-Z0-9*:] +[_a-zA-Z0-9*:] *)
→ (?<methodName>[_a-zA-Z0-9]+)\\(((?<arguments>[^\\)\n]*\\)\s*{(?<body>("[^""\n]+""|
→ [~{}]|\\n)+?)}"), "${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
173 // throw
174 (new Regex(@"(\\W)throw new(\\W)"), "$1throw$2", 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]+?\\)\\)", "$1$2 override", 0),
184 // return (range.Minimum, range.Maximum)
185 // return {range.Minimum, range.Maximum}
186 (new Regex(@"(?<before>return\\s*)\\(((?<values>[^\\)\n]+)\\)(?!\\(|(?<after>\\W))",
→ "${before}${values}${after}", 0),
187 // string
188 // std::string
189 (new Regex(@"(\\W)(?!:):)string(\\W)"), "$1std::string$2", 0),
190 // System.ValueTuple
191 // std::tuple
192 (new Regex(@"(?<before>\\W) (System\\.\\.)?ValueTuple(?:\\s*=|\\(|(?<after>\\W))",
→ "${before}std::tuple${after}", 0),
193 // sbyte
194 // std::int8_t
195 (new Regex(@"(?<before>\\W) ((System\\.\\.)?SB|sbyte(?:\\s*=|\\(|(?<after>\\W))",
→ "${before}std::int8_t${after}", 0),
196 // short

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

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251 (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),
252 // Remove scope borders.
253 // ~!root!~
254 //
255 (new Regex(@"~!(?<pointer>[a-zA-Z0-9]+)!~"), "", 5),
256 // ref auto root = ref
257 // ref auto root =
258 (new Regex(@"ref ([a-zA-Z0-9]+) ([a-zA-Z0-9]+) = ref(\W)", "$1* $2 =$3", 0),
259 // *root = ref left;
260 // root = left;
261 (new Regex(@"\*( [a-zA-Z0-9]+) = ref ([a-zA-Z0-9]+)(\W)", "$1 = $2$3", 0),
262 // (ref left)
263 // (left)
264 (new Regex(@"\ (ref ([a-zA-Z0-9]+) (\\|\\(|,))", "($1$2", 0),
265 // ref TElement
266 // TElement*
267 (new Regex(@"( |\\())ref ([a-zA-Z0-9]+) ", "$1$2* ", 0),
268 // ref sizeBalancedTree.Root
269 // &sizeBalancedTree->Root
270 (new Regex(@"ref ([a-zA-Z0-9]+)\\. ([a-zA-Z0-9\\*]+)", "&$1->$2", 0),
271 // ref GetElement(node).Right
272 // &GetElement(node)->Right
273 (new Regex(@"ref ([a-zA-Z0-9]+)\\(( [a-zA-Z0-9\\*]+)\\)\\. ([a-zA-Z0-9]+)",
    ↳ "&$1($2)->$3", 0),
274 // GetElement(node).Right
275 // GetElement(node)->Right
276 (new Regex(@"([a-zA-Z0-9]+)\\(( [a-zA-Z0-9\\*]+)\\)\\. ([a-zA-Z0-9]+)", "$1($2)->$3", 0),
277 // [Fact]\npublic: static void SizeBalancedTreeMultipleAttachAndDetachTest()
278 // public: TEST_METHOD(SizeBalancedTreeMultipleAttachAndDetachTest)
279 (new Regex(@"[Fact\\] [\\s\\n]+(public: )?(static )?void ([a-zA-Z0-9]+)\\(\\)", "public:
    ↳ TEST_METHOD($3)", 0),
280 // class TreesTests
281 // TEST_CLASS(TreesTests)
282 (new Regex(@"class ([a-zA-Z0-9]+Tests)", "TEST_CLASS($1)", 0),
283 // Assert.Equal
284 // Assert::AreEqual
285 (new Regex(@"(Assert)\\. ((Not)?Equal)", "$1::Are$2", 0),
286 // Assert.Throws
287 // Assert::ExpectException
288 (new Regex(@"(Assert)\\. Throws", "$1::ExpectException", 0),
289 // Assert.True
290 // Assert::IsTrue
291 (new Regex(@"(Assert)\\. (True|False)", "$1::Is$2", 0),
292 // $"Argument {argumentName} is null."
293 // std::string("Argument
    ↳ ").append(Platform::Converters::To<std::string>(argumentName)).append(" is
    ↳ null.")
294 (new Regex(@"\$"" (?<left>(\\""| [^""\\r\\n])*) { (?<expression>[_a-zA-Z0-9]+) } { (?<right>(\\
    ↳ |""| [^""\\r\\n])*) """,
    ↳ "std::string(\$""$ {left}\\").append(Platform::Converters::To<std::string>($ {expres
    ↳ sion})).append("\\$ {right}\\")",
    ↳ 10),
295 // $"
296 // "
297 (new Regex(@"\$"""), "\\\"", 0),
298 // std::string(std::string("[").append(Platform::Converters::To<std::string>(Minimum
    ↳ )), append(",
    ↳ )), append(Platform::Converters::To<std::string>(Maximum)).append("]")
299 // std::string("[").append(Platform::Converters::To<std::string>(Minimum)).append(",
    ↳ ").append(Platform::Converters::To<std::string>(Maximum)).append("]")
300 (new Regex(@"std::string\\((?<begin>std::string\\( ""(\\""| [^""]) *""\\) (\\.append\\((Platf
    ↳ orm::Converters::To<std::string>\\( [^\\n]+\\) | [^\\n]+\\)\\)\\)\\)\\.append",
    ↳ "$ {begin}.append", 10),
301 // Console.WriteLine("...")
302 // printf("...\\n")
303 (new Regex(@"Console\\. WriteLine\\( ""([^""\\r\\n]+) ""\\)", "printf\\( "\\$1\\n\\)", 0),
304 // TEElement Root;
305 // TEElement 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${after}" , 0) ,
316 // Insert scope borders.
317 // class Range { ... public: override std::string ToString() { return ...; }
318 // class Range { /*~Range<T>~/ ... public: override std::string ToString() { return
    ↳ ...; } }
319 (new Regex(@"(?<classDeclarationBegin>\\r?\\n(?<indent>[\\t ]*)template <typename
    ↳ (?<typeParameter>[\\<>\\n]+> (struct|class)
    ↳ (?<type>[a-zA-Z0-9]+<\\k<typeParameter>>) (\\s*:\\s*[\\^\\n]+)?[\\t ]*(\\r?\\n)?[\\t
    ↳ ]*(?<middle>((?!class|struct)\\.\\n)+?) (?<toStringDeclaration>(?<access>(private|
    ↳ |protected|public): )override std::string ToString\\(\\))" ,
    ↳ "${classDeclarationBegin}/*~${type}~/${middle}${toStringDeclaration}" , 0) ,
320 // Inside the scope of ~!Range!~ replace:
321 // public: override std::string ToString() { return ...; }
322 // public: operator std::string() const { return ...; }\\n\\npublic: friend
    ↳ std::ostream & operator <<(std::ostream &out, const A &obj) { return out <<
    ↳ (std::string)obj; } }
323 (new Regex(@"(?<scope>/\\*~(?<type>[_a-zA-Z0-9<>:]+)~/)(?<separator>\\.|\\n)(?<before>
    ↳ ((?!/\\*~\\k<type>~/)(\\.|\\n))*?) (?<toStringDeclaration>\\r?\\n(?<indent>[
    ↳ \\t ]*) (?<access>(private|protected|public): )override std::string ToString\\(\\)
    ↳ (?<toStringMethodBody>[\\^\\n]+))" , "${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>[^\s;]+\r\n*;)", "${scope}${separator}${before}{
    ↳ std::lock_guard<std::mutex> guard(${fieldName}_mutex);${after}", 10),
357 // Inside the scope of ~!_exceptionsBag!~ replace:
358 // _exceptionsBag.Add(exception);
359 // std::lock_guard<std::mutex> guard(_exceptionsBag_mutex); \r\n
    ↳ _exceptionsBag.Add(exception);
360 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*)(?<separator>.\s)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*)(.|\n))*?)\{?(?<after>((?!lock_guard)([^\s;]+\r\n))*?\r
    ↳ ?\n(?<indent>[\t ]*)\k<fieldName>[^\s;]+\r\n*;)",
    ↳ "${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
387 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.ToString\\("),
    ↳ "${scope}${separator}${before}${variable}", 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>(${argument}))".append(1, '\\n')",
    ↳ 10),
391 // sb.Append('\\t', level);
392 // sb.append(level, '\\t');
393 (new Regex(@"(?<scope>/\*~(?<variable>[a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ ((?!/\*~\k<variable>~\*/)(.\|\\n))*?)\k<variable>\.Append\\('(?<character>[^\|\\r\\n]
    ↳ +)', (?<count>[^\|\\n]+)\\)"),
    ↳ "${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] (?<!(?:|\\.|->|throw\\s+)) (?<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 ArgumentNullException(argumentName, message);
462 // throw std::invalid_argument(std::string("Argument
    ↳ ").append(argumentName).append(" is null: ").append(message).append("."));
463 (new Regex(@"throw
    ↳ 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 ArgumentException(message, argumentName);
465 // throw std::invalid_argument(std::string("Invalid ").append(argumentName).append("
    ↳ argument: ").append(message).append("."));
466 (new Regex(@"throw
    ↳ 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 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 ArgumentOutOfRangeException\((?<argument>[a-zA-Z]*[Aa]rgument[a-z]
    A-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 NotSupportedException();
// throw std::logic_error("Not supported exception.");
(new Regex(@"throw NotSupportedException\(\);)", "throw std::logic_error(\"Not
    supported exception.\");", 0),
// throw NotImplementedException();
// throw std::logic_error("Not implemented exception.");
(new Regex(@"throw 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\*]*~\*/)(?<separ
    eparator>.\|\\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)(?<be
    fore>(?<beforeExpression>(?(bracket>{)|(?(bracket>})|[\~\n\*]*?))\k<variable>.\|
    ↪ (?<field>[_a-zA-Z0-9]+)(?<after>(,|;|}|
    ↪ |\\n))(?<afterExpression>(?(bracket>{)|(?(bracket>})|[\~\n\*]*?))"),
    ↪ "${scope}${separator}${before}this->${field}${after}", 10),
516 // Remove scope borders.
517 // /*~ex~*/
518 //
519 (new Regex(@"/*~[~\n]+~[~\n]+~\*/"), "", 0),
520 // Insert scope borders.
521 // namespace Platform::Ranges { ... }
522 // namespace Platform::Ranges {/\~*start~namespace~Platform::Ranges~*/ ...
    ↪ /\~*end~namespace~Platform::Ranges~*/}
523 (new Regex(@"(?<namespaceDeclarationBegin>\r?\n(?<indent>[\t ]*)namespace
    ↪ (?<namespaceName>(?(namePart>[_a-zA-Z][_a-zA-Z0-9]+)(?(nextNamePart>::[_a-zA-Z][_a-z
    ↪ A-Z0-9]+)))(\s|\\n)*{(?<middle>.\|\\n)*}(?<end>(?(bracket>{)|(?(bracket>})|[\~\n\*]*?))"),
    ↪ "${namespaceDeclarationBegin}/\~*start~namespace~${namespaceName}~*/${middle}/\~*e
    ↪ nd~namespace~${namespaceName}~*/${end}",
    ↪ 0),
524 // Insert scope borders.
525 // class Range<T> { ... };
526 // class Range<T> {/\~*start~type~Range<T>~T~*/ ... /\~*start~type~Range<T>~T~*/};
527 (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>.\|\\n)*}(?<endIndent>(?(bracket>{)|(?(bracket>})|[\~\n\*]*?))"),
    ↪ "${classDeclarationBegin}/\~*start~type~${type}~${typeParameter}~*/${middle}${end
    ↪ Indent}/\~*end~type~${type}~${typeParameter}~*/${end}",
    ↪ 0),
528 // Inside scopes replace:
529 // /\~*start~namespace~Platform::Ranges~*/ ... /\~*start~type~Range<T>~T~*/ ...
    ↪ public: override std::int32_t GetHashCode() { return {Minimum,
    ↪ Maximum}.GetHashCode(); } ... /\~*start~type~Range<T>~T~*/ ...
    ↪ /\~*end~namespace~Platform::Ranges~*/
530 // /\~*start~namespace~Platform::Ranges~*/ ... /\~*start~type~Range<T>~T~*/ ...
    ↪ /\~*start~type~Range<T>~T~*/ ... /\~*end~namespace~Platform::Ranges~*/ namespace
    ↪ std { template <typename T> struct hash<Platform::Ranges::Range<T>> {
    ↪ std::size_t operator()(const Platform::Ranges::Range<T> &obj) const { return
    ↪ {Minimum, Maximum}.GetHashCode(); } }; }
531 (new Regex(@"(?<namespaceScopeStart>/\~*start~namespace~(?<namespace>[~\n\*]*~\*/)
    ↪ (?<betweenStartScopes>.\|\\n)+(?<typeScopeStart>/\~*start~type~(?<type>[~\n\*]*~\
    ↪ )~(?<typeParameter>[~\n\*]*~\*/)(?<before>.\|\\n)+?)(?<hashMethodDeclaration>\r
    ↪ ?\n[ \t]*(?<access>(private|protected|public): )override std::int32_t
    ↪ GetHashCode\\n)(\s|\\n)*{\s*(?<methodBody>[~\n\*]*~\s*}{\s*}(?<after>.\|\\n
    ↪ )+?)(?<typeScopeEnd>/\~*end~type~\k<type>~\k<typeParameter>~\*/)(?<betweenEndSco
    ↪ pes>.\|\\n)+(?<namespaceScopeEnd>/\~*end~namespace~\k<namespace>~\*/)}\r?\n"),
    ↪ "${namespaceScopeStart}${betweenStartScopes}${typeScopeStart}${before}${after}${{
    ↪ typeScopeEnd}${betweenEndScopes}${namespaceScopeEnd}" + Environment.NewLine +
    ↪ Environment.NewLine + "namespace std" + Environment.NewLine + "{" +
    ↪ Environment.NewLine + "    template <typename ${typeParameter}>" +
    ↪ Environment.NewLine + "    struct hash<${namespace}::${type}>" +
    ↪ Environment.NewLine + "    {" + Environment.NewLine + "        std::size_t
    ↪ operator()(const ${namespace}::${type} &obj) const" + Environment.NewLine + "
    ↪ {" + Environment.NewLine + "
    ↪ /\~*start~method~*/${methodBody}/\~*end~method~*/" + Environment.NewLine + "
    ↪ }" + Environment.NewLine + "    };" + Environment.NewLine + "}" +
    ↪ Environment.NewLine, 10),
532 // Inside scope of /\~*start~method~*/ replace:
533 // /\~*start~method~*/ ... Minimum ... /\~*end~method~*/
534 // /\~*start~method~*/ ... obj.Minimum ... /\~*end~method~*/
535 (new Regex(@"(?<methodScopeStart>/\~*start~method~\*/)(?<before>.{|,
    ↪ })(?<name>[_a-zA-Z][_a-zA-Z0-9]+)(?<after>[~\n\*]*~\k<type>~\k<typeParameter>~\*/)
    ↪ ([~\n\*]*~\k<type>~\k<typeParameter>~\*/)",
    ↪ "${methodScopeStart}${before}obj.${name}.${type}.${methodScopeEnd}", 10),
536 // Remove scope borders.

```

```

// /*~start~type~Range<T>~*/
//
// (new Regex(@"/*~[~\*\n]+(~[~\*\n]+)*~*/"), "", 0),
}.Cast<ISubstitutionRule>().ToList();

public static readonly IList<ISubstitutionRule> LastStage = new List<SubstitutionRule>
{
    // ICounter<int, int> c1;
    // ICounter<int, int>* c1;
    (new Regex(@"(?<abstractType>I[A-Z][a-zA-Z0-9]+(<[^\r\n]+>)?
    → (?<variable>[_a-zA-Z0-9]+)(?<after> = null)?;"), "${abstractType}*
    → ${variable}${after};", 0),
    // (expression)
    // expression
    (new Regex(@"(\(|\)|\((([a-zA-Z0-9_]*:~)+\)|(|;|\\))"), "$1$2$3", 0),
    // (method(expression))
    // method(expression)
    (new Regex(@"(?<firstSeparator>(\(|
    → ))\(((?<method>[_a-zA-Z0-9_~\>~*~]+)\(((?<expression>((?<parenthesis>\(|(?<-parent
    → hesis>~))|[_a-zA-Z0-9_~\>~*~]+)(?<parenthesis>(?!))~)\)((?<lastSeparator>~,|
    → |;|\\)))"), "${firstSeparator}${method}(${expression})${lastSeparator}", 0),
    // .append(".")
    // .append(1, '.');
    (new Regex(@"\\.append\\(\"\"([~\\\"\"]|\\[~\"\"]\"\"\\)\")", ".append(1, '$1')", 0),
    // return ref _elements[node];
    // return &_elements[node];
    (new Regex(@"return ref ([_a-zA-Z0-9]+)\\([[_a-zA-Z0-9~*~]+\\];"), "return &1[2];",
    → 0),
    // ((1, 2))
    // ({1, 2})
    (new Regex(@"(?<before>\\(|, )\\(((?<first>[~\\n()+),
    → (?<second>[~\\n()+)~\\)((?<after>\\(|, )"), "${before}${{first},
    → ${second}}${after}", 10),
    // {1, 2}.GetHashCode()
    // Platform::Hashing::Hash(1, 2)
    (new Regex(@"{(?<first>[~\\n{}]+), (?<second>[~\\n{}]+)}\\.GetHashCode\\(\\)",
    → "Platform::Hashing::Hash(${first}, ${second})", 10),
    // range.ToString()
    // Platform::Converters::To<std::string>(range).data()
    (new Regex(@"(?<before>\\W)(?<variable>[_a-zA-Z][_a-zA-Z0-9]+)\\.ToString\\(\\)",
    → "${before}Platform::Converters::To<std::string>(${variable}).data()", 10),
    // new
    //
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)new\\
    → s+\""), "${before}",
    → 10),
    // x == null
    // x == nullptr
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)(?<v
    → ariable>[_a-zA-Z][_a-zA-Z0-9]+)(?<operator>\\s*(==|!=)\\s*)null(?<after>\\W\""),
    → "${before}${variable}${operator}nullptr${after}", 10),
    // null
    // {}
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)null
    → (?<after>\\W\""), "${before}{}${after}",
    → 10),
    // default
    // 0
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)defa
    → ult(?<after>\\W\""), "${before}0${after}",
    → 10),
    // object x
    // void *x
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)([O|
    → o]bject|System\\.Object) (?<after>\\w\""), "${before}void *${after}",
    → 10),
    // <object>
    // <void*>
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)(?<!
    → \\w )([O|o]bject|System\\.Object)(?<after>\\W\""), "${before}void*${after}",
    → 10),
    // ArgumentNullException
    // std::invalid_argument
    (new Regex(@"(?<before>\\r?\\n[~\"\"\\r\\n]*(\"\"(\\\\\"\"| [~\"\"\\r\\n])*\"\"[~\"\"\\r\\n]*)*)(?<=\\W)(Sys
    → tem\\.)?ArgumentNullException(?<after>\\W\""),
    → "${before}std::invalid_argument${after}", 10),

```

```

589 // InvalidOperationException
590 // std::runtime_error
591 (new Regex(@"(\W)(InvalidOperationException|Exception)(\W)"),
    → "$1std::runtime_error$3", 0),
592 // ArgumentException
593 // std::invalid_argument
594 (new Regex(@"(\W)(ArgumentException|ArgumentOutOfRangeException)(\W)"),
    → "$1std::invalid_argument$3", 0),
595 // template <typename T> struct Range : IEquatable<Range<T>>
596 // template <typename T> struct Range {
597 (new Regex(@"(?<before>template <typename (?<typeParameter>[^\n]+)> (struct|class)
    → (?<type>[a-zA-Z0-9]+<[^\n]+>)) : (public
    → )?IEquatable<k<type>>(?(after>(\s|\n)*{) )", "${before}${after}", 0),
598 // #region Always
599 //
600 (new Regex(@"(^\r?\n)[ \t]*\#(region|endregion)[^\r\n]*(\r?\n|$)", "", 0),
601 // // #define ENABLE_TREE_AUTO_DEBUG_AND_VALIDATION
602 //
603 (new Regex(@"\\[/[ \t]*\#define[ \t]+[_a-zA-Z0-9]+[ \t]*")", "", 0),
604 // #if USEARRAYPOOL\r\n#endif
605 //
606 (new Regex(@"#if [a-zA-Z0-9]+\s+#endif")", "", 0),
607 // [Fact]
608 //
609 (new Regex(@"(?<firstNewLine>\r?\n|\A)(?<indent>[ \t
    → ]+)\[[a-zA-Z0-9]+\((?<expression>((?<parenthesis>\()|(?<-parenthesis>\))|~()\r\
    → \n)*+)(?(parenthesis)(?!))\)?\][ \t]*(\r?\n\k<indent>?)")",
    → "${firstNewLine}${indent}", 5),
610 // \A \n ... namespace
611 // \Anamespace
612 (new Regex(@"(\A)(\r?\n)+namespace")", "$1namespace", 0),
613 // \A \n ... class
614 // \Aclass
615 (new Regex(@"(\A)(\r?\n)+class")", "$1class", 0),
616 // \n\n\n
617 // \n\n
618 (new Regex(@"\r?\n[ \t]*\r?\n[ \t]*\r?\n")", Environment.NewLine +
    → Environment.NewLine, 50),
619 // {\n\n
620 // {\n
621 (new Regex(@"{[ \t]*\r?\n[ \t]*\r?\n")", "{" + Environment.NewLine, 10),
622 // \n\n}
623 // \n}
624 (new Regex(@"\r?\n[ \t]*\r?\n(?<end>[ \t]*)")", Environment.NewLine + "${end}", 10),
625 }.Cast<ISubstitutionRule>().ToList();
626
627 public CSharpToCppTransformer(IList<ISubstitutionRule> extraRules) :
    → base(FirstStage.Concat(extraRules).Concat>LastStage).ToList()) { }
628
629 public CSharpToCppTransformer() : base(FirstStage.Concat>LastStage).ToList()) { }
630 }
631 }

```

1.2 ./csharp/Platform.RegularExpressions.Transformer.CSharpToCpp.Tests/CSharpToCppTransformerTests.cs

```

1 using Xunit;
2
3 namespace Platform.RegularExpressions.Transformer.CSharpToCpp.Tests
4 {
5     public class CSharpToCppTransformerTests
6     {
7         [Fact]
8         public void EmptyLineTest()
9         {
10             // This test can help to test basic problems with regular expressions like incorrect
            → syntax
11             var transformer = new CSharpToCppTransformer();
12             var actualResult = transformer.Transform("");
13             Assert.Equal("", actualResult);
14         }
15
16         [Fact]
17         public void HelloWorldTest()
18         {
19             const string helloWorldCode = @"using System;
20 class Program
21 {
22     public static void Main(string[] args)
23     {

```

```
24         Console.WriteLine("Hello, world!");
25     }
26 };
27     const string expectedResult = @"class Program
28     {
29     public: static void Main(std::string args[])
30     {
31         printf("Hello, world!\n");
32     }
33 };";
34     var transformer = new CSharpToCppTransformer();
35     var actualResult = transformer.Transform(helloWorldCode);
36     Assert.Equal(expectedResult, actualResult);
37     }
38 }
39 }
```


Index

./csharp/Platform.RegularExpressions.Transformer.CSharpToCpp.Tests/CSharpToCppTransformerTests.cs, 14

./csharp/Platform.RegularExpressions.Transformer.CSharpToCpp/CSharpToCppTransformer.cs, 1