

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<ISubstitutionRule> FirstStage = new List<SubstitutionRule>
13         {
14             // // ...
15             //
16             (new Regex(@"(\r?\n)?[ \t]++/.+"), "", 0),
17             // #pragma warning disable CS1591 // Missing XML comment for publicly visible type
18             // or member
19             //
20             (new Regex(@"^-s*?\#pragma\[sa-zA-Z0-9]+\$"), "", 0),
21             // {\n\n\n
22             // {
23             (new Regex(@"{\s+[\r\n]+") , "{" + Environment.NewLine, 0),
24             // Platform.Collections.Methods.Lists
25             // Platform::Collections::Methods::Lists
26             (new Regex(@"(namespace[^\r\n]+?)\.([^\r\n]+?)") , "$1::$2", 20),
27             // nameof(numbers)
28             // "numbers"
29             (new
30             ↪ Regex(@"(?<before>\W)nameof\(((^)\n)+\.)?(?<name>[a-zA-Z0-9_]+)(<(^)\n)+)?\)",
31             ↪ "${$before}\"{$name}\"", 0),
32             // Insert markers
33             // EqualityComparer<T> _equalityComparer = EqualityComparer<T>.Default;
34             // EqualityComparer<T> _equalityComparer =
35             ↪ EqualityComparer<T>.Default; /*~_comparer~/
36             (new Regex(@"(?<declaration>EqualityComparer<(?<type>[^\n]+)>
37             ↪ (?<comparer>[a-zA-Z0-9_]+) = EqualityComparer<\k<type>>\.Default;)" ,
38             ↪ "{$declaration}/*~${comparer}~/", 0),
39             // /*~_equalityComparer~/..._equalityComparer.Equals(Minimum, value)
40             // /*~_equalityComparer~/...Minimum == value
41             (new Regex(@"(?<before>/\/*~(?<comparer>[a-zA-Z0-9_]+)~\*/(.|\n)+\W)\k<comparer>\.Equ_
42             ↪ als\((?<left>[^\n]+), (?<right>[^\n]+)\)", "{$before}${left} == ${right}",
43             ↪ 50),
44             // Remove markers
45             // /*~_equalityComparer~/
46             //
47             (new Regex(@"\r?\n[^\n]+/\/*~[a-zA-Z0-9_]+~\*/") , "", 10),
48             // Insert markers
49             // Comparer<T> _comparer = Comparer<T>.Default;
50             // Comparer<T> _comparer = Comparer<T>.Default; /*~_comparer~/
51             (new Regex(@"(?<declaration>Comparer<(?<type>[^\n]+)> (?<comparer>[a-zA-Z0-9_]+) =
52             ↪ Comparer<\k<type>>\.Default;)" , "{$declaration}/*~${comparer}~/", 0),
53             // /*~_comparer~/..._comparer.Compare(Minimum, value) <= 0
54             // /*~_comparer~/...Minimum <= value
55             (new Regex(@"(?<before>/\/*~(?<comparer>[a-zA-Z0-9_]+)~\*/(.|\n)+\W)\k<comparer>\.Com_
56             ↪ pare\((?<left>[^\n]+),
57             ↪ (?<right>[^\n]+)\)\s*(?<comparison>[<=>=?)\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 ==\(((?<type>[^\n]+) (?<left>[a-zA-Z0-9_]+),
73             ↪ \k<type> (?<right>[a-zA-Z0-9_]+)\) ==>
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}${after}", 10),
66 // public ...
67 // public: ...
68 (new Regex(@"(?<newLineAndIndent>\r?\n?[
    ↳ \t]*) (?<before>[^\{\\(\r\n)*) (?<access>private|protected|public) [ \t]+(?![^\{\\(\r
    ↳ \n]*((?<=\\s)|\\W) (interface|class|struct) (\\W) [^\{\\(\r\n)*[\\{\\(\r\n)]"),
    ↳ "${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}>${typeDefinitionEnding}{", 0),
    ↳ "public:", 0),
84 // template <typename TObject, TProperty, TValue>
85 // template <typename TObject, typename TProperty, typename TValue>
86 (new Regex(@"(?<before>template <((, )?typename [a-zA-Z0-9]+)+,
    ↳ )(?<typeParameter>[a-zA-Z0-9]+)(?<after>(,|>))", "${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 // private: static readonly Disposal _emptyDelegate = (manual, wasDisposed) => { };
107 // private: inline static std::function<Disposal> _emptyDelegate = [](auto manual,
108   ↳ auto wasDisposed) { };
109 (new Regex(@"(?<access>(private|protected|public): )?static readonly
110   ↳ (?<type>[a-zA-Z][a-zA-Z0-9]*) (?<name>[a-zA-Z_][a-zA-Z0-9_]*) =
111   ↳ \((?<firstArgument>[a-zA-Z_][a-zA-Z0-9_]*)
112   ↳ (?<secondArgument>[a-zA-Z_][a-zA-Z0-9_]*)\)\s=> {\s*};");, "${access}inline static
113   ↳ std::function<${type}> ${name} = [](auto ${firstArgument}, auto
114   ↳ ${secondArgument}) { };", 0),
115 // public: static readonly EnsureAlwaysExtensionRoot Always = new
116   ↳ EnsureAlwaysExtensionRoot();
117 // public: inline static EnsureAlwaysExtensionRoot Always;
118 (new Regex(@"(?<access>(private|protected|public): )?static readonly
119   ↳ (?<type>[a-zA-Z0-9]+(<[a-zA-Z0-9]+>?)) (?<name>[a-zA-Z0-9_]+) = new
120   ↳ \k<type>\(\);");, "${access}inline static ${type} ${name};", 0),
121 // public: static readonly Range<int> SByte = new
122   ↳ Range<int>(std::numeric_limits<int>::min(), std::numeric_limits<int>::max());
123 // public: inline static Range<int> SByte =
124   ↳ Range<int>(std::numeric_limits<int>::min(), std::numeric_limits<int>::max());
125 (new Regex(@"(?<access>(private|protected|public): )?static readonly
126   ↳ (?<type>[a-zA-Z0-9]+(<[a-zA-Z0-9]+>?)) (?<name>[a-zA-Z0-9_]+) = new
127   ↳ \k<type>\(\((?<arguments>[^\n]+)\)\);");, "${access}inline static ${type} ${name} =
128   ↳ ${type}(${arguments});", 0),
129 // public: static readonly string ExceptionContentsSeparator = "---";
130 // public: inline static std::string ExceptionContentsSeparator = "---";
131 (new Regex(@"(?<access>(private|protected|public): )?(const|static readonly) string
132   ↳ (?<name>[a-zA-Z0-9_]+) = ""(?<string>\\\\"|"[^"]*\r\n")+"";");, "${access}inline
133   ↳ static std::string ${name} = \"${string}\";");, 0),
134 // private: const int MaxPath = 92;
135 // private: inline static const int MaxPath = 92;
136 (new Regex(@"(?<access>(private|protected|public): )?(const|static readonly)
137   ↳ (?<type>[a-zA-Z0-9]+) (?<name>[_a-zA-Z0-9]+) = (?<value>[^\r\n]+);");,
138   ↳ "${access}inline static const ${type} ${name} = ${value};", 0),
139 // ArgumentNotNull(EnsureAlwaysExtensionRoot root, TArgument argument) where
140   ↳ TArgument : class
141 // ArgumentNotNull(EnsureAlwaysExtensionRoot root, TArgument* argument)
142 (new Regex(@"(?<before> [a-zA-Z]+\((([a-zA-Z *,]+, |))(?<type>[a-zA-Z]+)(?<after>(|
143   ↳ [a-zA-Z *,]+)\))\s[ \r\n]+where \k<type> : class");, "${before}${type}*${after}",
144   ↳ 0),
145 // protected: abstract TElement GetFirst();
146 // protected: virtual TElement GetFirst() = 0;
147 (new Regex(@"(?<access>(private|protected|public): )?abstract
148   ↳ (?<method>[^\r\n]+);");, "${access}virtual ${method} = 0;";, 0),
149 // TElement GetFirst();
150 // virtual TElement GetFirst() = 0;
151 (new Regex(@"(?<before>[ \r\n]+[ ]+)(?<methodDeclaration>(?!return)[a-zA-Z0-9]+
152   ↳ [a-zA-Z0-9]+\((([^\r\n]|\r\n)*\))\s(?<after>[ ]*\s[ \r\n]+)");, "${before}virtual
153   ↳ ${methodDeclaration} = 0${after}", 1),
154 // protected: readonly TreeElement[] _elements;
155 // protected: TreeElement _elements[N];
156 (new Regex(@"(?<access>(private|protected|public): )?readonly
157   ↳ (?<type>[a-zA-Z<>0-9]+)(\[ \[ \] \+ ) (?<name>[_a-zA-Z0-9]+);");, "${access}${type}
158   ↳ ${name}[N];";, 0),
159 // protected: readonly TElement Zero;
160 // protected: TElement Zero;
161 (new Regex(@"(?<access>(private|protected|public): )?readonly
162   ↳ (?<type>[a-zA-Z<>0-9]+) (?<name>[_a-zA-Z0-9]+);");, "${access}${type} ${name};";,
163   ↳ 0),
164 // internal
165 //
166 (new Regex(@"(\W)internal\s+");, "$1", 0),
167 // static void NotImplementedException(ThrowExtensionRoot root) => throw new
168   ↳ NotImplementedException();

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137 // static void NotImplementedException(ThrowExtensionRoot root) { return throw new
138     ↳ NotImplementedException(); }
139 (new Regex(@"(^s+)(private|protected|public)?(: )?(template \<[^>\r\n]+\> )?(static
140     ↳ )?(override )?([a-zA-Z0-9]+
141     ↳ )([a-zA-Z0-9]+\((([^\(\r\n]*)\)\s+=>\s+throw([^\(\r\n]+);"),
142     ↳ "$1$2$3$4$5$6$7$8($9) { throw$10; }", 0),
143 // SizeBalancedTree(int capacity) => a = b;
144 // SizeBalancedTree(int capacity) { a = b; }
145 (new Regex(@"(^s+)(private|protected|public)?(: )?(template \<[^>\r\n]+\> )?(static
146     ↳ )?(override )?(void )?([a-zA-Z0-9]+\((([^\(\r\n]*)\)\s+=>\s+([^\(\r\n]+);"),
147     ↳ "$1$2$3$4$5$6$7$8($9) { $10; }", 0),
148 // int SizeBalancedTree(int capacity) => a;
149 // int SizeBalancedTree(int capacity) { return a; }
150 (new Regex(@"(^s+)(private|protected|public)?(: )?(template \<[^>\r\n]+\> )?(static
151     ↳ )?(override )?([a-zA-Z0-9]+
152     ↳ )([a-zA-Z0-9]+\((([^\(\r\n]*)\)\s+=>\s+([^\(\r\n]+);"), "$1$2$3$4$5$6$7$8($9) {
153     ↳ return $10; }", 0),
154 // OnDispose = (manual, wasDisposed) =>
155 // OnDispose = [&](auto manual, auto wasDisposed)
156 (new Regex(@"(?<variable>[a-zA-Z_][a-zA-Z0-9_]*) (?<operator>\s*[\+=\s*])\(((?<firstArg_
157     ↳ ument>[a-zA-Z_][a-zA-Z0-9_]*) ,
158     ↳ (?<secondArgument>[a-zA-Z_][a-zA-Z0-9_]*)\)\s*=>"),
159     ↳ "$${variable}$$operator [&](auto $${firstArgument}, auto $${secondArgument})", 0),
160 // () => Integer<TElement>.Zero;
161 // () { return Integer<TElement>.Zero; }
162 (new Regex(@"\(\)\s+=>\s+(?<expression>[^\(\); \r\n]+(\(((?<parenthesis>\(|(?<-parent_
163     ↳ hesis>\)|[^\(\); \r\n]*)*)?)[^\(\); \r\n]*(?<after>,|;))"), "() { return
164     ↳ $${expression}; }$${after}", 0),
165 // ~DisposableBase() => Destruct();
166 // ~DisposableBase() { Destruct(); }
167 (new Regex(@"~(?<class>[a-zA-Z_][a-zA-Z0-9_]*)\(\)\s+=>\s+([^\(\r\n]+?);"),
168     ↳ "~$${class}() { $1; }", 0),
169 // => Integer<TElement>.Zero;
170 // { return Integer<TElement>.Zero; }
171 (new Regex(@"\)\s+=>\s+([^\(\r\n]+?);"), ") { return $1; }", 0),
172 // () { return avlTree.Count; }
173 // [&]()-> auto { return avlTree.Count; }
174 (new Regex(@"(?<before>, |)\(\)\s+{ return (?<expression>[^\(\r\n]+); }"),
175     ↳ "$${before} [&]()-> auto { return $${expression}; }", 0),
176 // Count => GetSizeOrZero(Root);
177 // Count() { return GetSizeOrZero(Root); }
178 (new Regex(@"(\W)([A-Z][a-zA-Z])\s+=>\s+([^\(\r\n]+);"), "$1$2() { return $3; }", 0),
179 // Insert scope borders.
180 // interface IDisposable { ... }
181 // interface IDisposable { /*~start~interface~IDisposable~*/ ...
182     ↳ /*~end~interface~IDisposable~*/
183 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)interface[\t
184     ↳ ]*(?<type>[a-zA-Z_][a-zA-Z0-9_]*(<[^\<>\n]*?)[^\{]*\{ (?<middle>(.|\n)*)(?<beforeE_
185     ↳ nd>(?<=\r?\n)\k<indent>)(?<end>})"),
186     ↳ "$${classDeclarationBegin}/*~start~interface~$${type}~*/$${middle}$${beforeEnd}/*~en_
187     ↳ d~interface~$${type}~*/$${end}",
188     ↳ 0),
189 // Inside the scope replace:
190 // /*~start~interface~IDisposable~*/ ... bool IsDisposed { get; } ...
191     ↳ /*~end~interface~IDisposable~*/
192 // /*~start~interface~IDisposable~*/ ... virtual bool IsDisposed() = 0;
193     ↳ /*~end~interface~IDisposable~*/
194 (new Regex(@"(?<before>(?<typeScopeStart>\/\/*~start~interface~(?<type>[^\n\*]+)~\/*\/)
195     ↳ (.|\n)+?)(?<propertyDeclaration>(?<access>(private|protected|public):
196     ↳ )?(?<propertyType>[a-zA-Z_][a-zA-Z0-9_]*(<[^\<>\n]*?)) [^\{]*\{ (?<middle>(.|\n)*)(?<beforeE_
197     ↳ nd>(?<=\r?\n)\k<indent>)(?<end>})"),
198     ↳ "$${classDeclarationBegin}/*~start~interface~$${type}~*/$${middle}$${beforeEnd}/*~en_
199     ↳ d~interface~$${type}~*/$${end}",
200     ↳ 0),
201 // Remove scope borders.
202 // /*~start~interface~IDisposable~*/
203 //
204 (new Regex(@"\/\/*~[^\n\*]+(~[^\n\*]+)*~\/*\/"), "", 0),
205 // public: T Object { get; }
206 // public: const T Object;
207 (new Regex(@"(?<before>[^\r]\r?\n[ \t]*)(?<access>(private|protected|public):
208     ↳ )?(?<type>[a-zA-Z_][a-zA-Z0-9_]*(<[^\<>\n]*?))
209     ↳ (?<property>[a-zA-Z_][a-zA-Z0-9_]*)(?<blockOpen>[\n\s]*{[\n\s]*)(\[ [^\n]+ \] [\n\s]
210     ↳ ]*)?get; (?<blockClose>[\n\s]*})(?<after>[\n\s]*")", "$${before}$${access}const
211     ↳ $${type} $${property};$${after}", 2),
212 // public: bool IsDisposed { get => _disposed > 0; }
213 // public: bool IsDisposed() { return _disposed > 0; }

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180 (new Regex(@"(?<before>[^\r]\r?\n[ \t]*) (?<access>(private|protected|public):
    )?(?<virtual>virtual )?bool
    → (?<property>[a-zA-Z_][a-zA-Z0-9_]*) (?<blockOpen>[\n\s]*{[\n\s]*}(\[[^\n]+\][\n\s]
    → ]*)?get\s*=>\s*(?<expression>[^\n]+); (?<blockClose>[\n\s]*{[\n\s]*})",
    → "${before}${access}${virtual}bool ${property}() ${blockOpen}return
    → ${expression}; ${blockClose}", 2),
181 // protected: virtual std::string ObjectName { get => GetType().Name; }
182 // protected: virtual std::string ObjectName() { return GetType().Name; }
183 (new Regex(@"(?<before>[^\r]\r?\n[ \t]*) (?<access>(private|protected|public):
    )?(?<virtual>virtual )?(?<type>[a-zA-Z_][a-zA-Z0-9_<:;>]*)
    → (?<property>[a-zA-Z_][a-zA-Z0-9_]*) (?<blockOpen>[\n\s]*{[\n\s]*}(\[[^\n]+\][\n\s]
    → ]*)?get\s*=>\s*(?<expression>[^\n]+); (?<blockClose>[\n\s]*{[\n\s]*})",
    → "${before}${access}${virtual}${type} ${property}() ${blockOpen}return
    → ${expression}; ${blockClose}", 2),
184 // ArgumentInRange(string message) { string messageBuilder() { return message; }
185 // ArgumentInRange(string message) { auto messageBuilder = [&]() -> string { return
    → message; };
186 (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),
187 // Func<TElement> treeCount
188 // std::function<TElement()> treeCount
189 (new Regex(@"Func<([a-zA-Z0-9]+)> ([a-zA-Z0-9]+)", "std::function<$1()> $2", 0),
190 // Action<TElement> free
191 // std::function<void(TElement)> free
192 (new Regex(@"Action<(?<typeParameters>[a-zA-Z0-9]+(,
    → ([a-zA-Z0-9]+))*> (?<after>| (?<variable>[a-zA-Z0-9]+)))",
    → "std::function<void(${typeParameters})> ${after}", 0),
193 // Predicate<TArgument> predicate
194 // std::function<bool(TArgument)> predicate
195 (new Regex(@"Predicate<([a-zA-Z0-9]+)> ([a-zA-Z0-9]+)", "std::function<bool($1)>
    → $2", 0),
196 // var
197 // auto
198 (new Regex(@"(\W)var(\W)", "$1auto$2", 0),
199 // unchecked
200 //
201 (new Regex(@"[\r\n]{2}\s*?unchecked\s*?$)", "", 0),
202 // throw new
203 // throw
204 (new Regex(@"(\W)throw new(\W)", "$1throw$2", 0),
205 // void RaiseExceptionIgnoredEvent(Exception exception)
206 // void RaiseExceptionIgnoredEvent(const std::exception& exception)
207 (new Regex(@"(\\(| ) (System\\.Exception|Exception) (|\\))", "$1const
    → std::exception&$3", 0),
208 // EventHandler<Exception>
209 // EventHandler<std::exception>
210 (new Regex(@"(\W) (System\\.Exception|Exception) (\W)", "$1std::exception$3", 0),
211 // override void PrintNode(TElement node, StringBuilder sb, int level)
212 // void PrintNode(TElement node, StringBuilder sb, int level) override
213 (new Regex(@"override ([a-zA-Z0-9 \*+]+)\\((^\\)\r\n+?\\))", "$1$2 override", 0),
214 // return (range.Minimum, range.Maximum)
215 // return {range.Minimum, range.Maximum}
216 (new Regex(@"(?<before>return\s*)\\((?<values>[^\)\n]+\))\\(?!\\() (?<after>\W)",
    → "${before}${values}${after}", 0),
217 // string
218 // std::string
219 (new Regex(@"(?<before>\W) (?<!:):)string(?<after>\W)",
    → "${before}std::string${after}", 0),
220 // System.ValueTuple
221 // std::tuple
222 (new Regex(@"(?<before>\W) (System\\.)?ValueTuple(?:\s*=\|\\() (?<after>\W)",
    → "${before}std::tuple${after}", 0),
223 // sbyte
224 // std::int8_t
225 (new Regex(@"(?<before>\W) ((System\\.)?SB|sb)yte(?:\s*=\|\\() (?<after>\W)",
    → "${before}std::int8_t${after}", 0),
226 // short
227 // std::int16_t
228 (new Regex(@"(?<before>\W) ((System\\.)?Int16|short) (?! \s*=\|\\() (?<after>\W)",
    → "${before}std::int16_t${after}", 0),
229 // int
230 // std::int32_t

```

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231 (new Regex(@"(?<before>\W)((System\.)?I|i)nt(32)?(?!\s*=\|()\ (?<after>\W)"),
232     ↳ "${before}std::int32_t${after}", 0),
233 // long
234 (new Regex(@"(?<before>\W)((System\.)?Int64|long)(?! \s*=\|()\ (?<after>\W)"),
235     ↳ "${before}std::int64_t${after}", 0),
236 // byte
237 (new Regex(@"(?<before>\W)((System\.)?Byte|byte)(?! \s*=\|()\ (?<after>\W)"),
238     ↳ "${before}std::uint8_t${after}", 0),
239 // ushort
240 (new Regex(@"(?<before>\W)((System\.)?UInt16|ushort)(?! \s*=\|()\ (?<after>\W)"),
241     ↳ "${before}std::uint16_t${after}", 0),
242 // uint
243 (new Regex(@"(?<before>\W)((System\.)?UI|ui)nt(32)?(?!\s*=\|()\ (?<after>\W)"),
244     ↳ "${before}std::uint32_t${after}", 0),
245 // ulong
246 (new Regex(@"(?<before>\W)((System\.)?UInt64|ulong)(?! \s*=\|()\ (?<after>\W)"),
247     ↳ "${before}std::uint64_t${after}", 0),
248 // char*[] args
249 (new Regex(@"([_a-zA-Z0-9:\*]?)\[\] ([a-zA-Z0-9]+)", "$1 $2[]", 0),
250 // float.MinValue
251 (new Regex(@"(?<before>\W)(?<type>std::[a-z0-9_]+|float|double)\.MinValue(?<after>\W|
252     ↳ )"), "${before}std::numeric_limits<${type}>::lowest()${after}",
253     ↳ 0),
254 // double.MaxValue
255 (new Regex(@"(?<before>\W)(?<type>std::[a-z0-9_]+|float|double)\.MaxValue(?<after>\W|
256     ↳ )"), "${before}std::numeric_limits<${type}>::max()${after}",
257     ↳ 0),
258 // using Platform.Numbers;
259 //
260 (new Regex(@"([\r\n]{2}|^)\s*?using [\.a-zA-Z0-9]+\s*?${$}", "", 0),
261 // class SizedBinaryTreeMethodsBase : GenericCollectionMethodsBase
262 // class SizedBinaryTreeMethodsBase : public GenericCollectionMethodsBase
263 (new Regex(@"(struct|class) ([a-zA-Z0-9]+)(<[a-zA-Z0-9_ ,]+>)? : ([a-zA-Z0-9]+)",
264     ↳ "$1 $2$3 : public $4", 0),
265 // System.IDisposable
266 // System::IDisposable
267 (new Regex(@"(?<before>System(::[a-zA-Z_]\w*)*)\. (?<after>[a-zA-Z_]\w*)"),
268     ↳ "${before}::${after}", 20),
269 // class IProperty : ISetter<TValue, TObjct>, IProvider<TValue, TObjct>
270 // class IProperty : public ISetter<TValue, TObjct>, public IProvider<TValue,
271     ↳ TObjct>
272 (new Regex(@"(?<before>(interface|struct|class) [a-zA-Z_]\w* : ((public
273     ↳ [a-zA-Z_]\w*:)*(<[a-zA-Z0-9_ ,]+>)?,
274     ↳ )+)?(?<inheritedType>(?!public)[a-zA-Z_]\w*:)*(<[a-zA-Z0-9_ ,]+>)?(?<after>(,
275     ↳ [a-zA-Z_]\w*:)*(!>)|[ \r\n]+))", "${before}public ${inheritedType}${after}",
276     ↳ 10),
277 // interface IDisposable {
278 // class IDisposable { public:
279 (new Regex(@"(?<before>\r?\n)(?<indent>[ \t]*)interface
280     ↳ (?<interface>[a-zA-Z_]\w*)(?<typeDefinitionEnding>[~{}+]{})",
281     ↳ "${before}${indent}class ${interface}${typeDefinitionEnding}{\" +
282     ↳ Environment.NewLine + "      public:", 0),
283 // struct TreeElement { }
284 // struct TreeElement { };
285 (new Regex(@"(struct|class) ([a-zA-Z0-9]+)(\s+){([\sa-zA-Z0-9;:_]+?)}([~;])", "$1
286     ↳ $2$3{$4};$5", 0),
287 // class Program { }
288 // class Program { };
289 (new Regex(@"(?<type>struct|class)
290     ↳ (?<name>[a-zA-Z0-9_][^r\n]*) (?<beforeBody>[r\n]+(?<indentLevel>[ \t
291     ↳ ]*)?)\{(?<body>[S\s]+?[r\n]+\k<indentLevel>)\}(?<afterBody>[~;]|$)", "${type}
292     ↳ ${name}${beforeBody}${body}};${afterBody}", 0),
293 // Insert scope borders.
294 // ref TElement root
295 // ~!root!~ref TElement root
296 (new Regex(@"(?<definition>(?!= \|()\ (ref [a-zA-Z0-9_]+|[a-zA-Z0-9_]+(?<ref>))
297     ↳ (?<variable>[a-zA-Z0-9_]+)(?=\|, \| =))", "~!${variable}!~${definition}", 0),
298 // Inside the scope of ~!root!~ replace:

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282 // root
283 // *root
284 (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),
285 // Remove scope borders.
286 // ~!root!~
287 //
288 (new Regex(@"~!(?<pointer>[a-zA-Z0-9]+)!~"), "", 5),
289 // ref auto root = ref
290 // ref auto root =
291 (new Regex(@"ref ([a-zA-Z0-9]+) ([a-zA-Z0-9]+) = ref(\W)"), "$1* $2 =$3", 0),
292 // *root = ref left;
293 // root = left;
294 (new Regex(@"\*([a-zA-Z0-9]+) = ref ([a-zA-Z0-9]+)(\W)"), "$1 = $2$3", 0),
295 // (ref left)
296 // (left)
297 (new Regex(@"\ (ref ([a-zA-Z0-9]+)(\\|\\(|,))"), "($1$2", 0),
298 // ref TElement
299 // TElement*
300 (new Regex(@"(\\|\\())ref ([a-zA-Z0-9]+) "), "$1$2* ", 0),
301 // ref sizeBalancedTree.Root
302 // &sizeBalancedTree->Root
303 (new Regex(@"ref ([a-zA-Z0-9]+)\\.([a-zA-Z0-9\\*]+)"), "&$1->$2", 0),
304 // ref GetElement(node).Right
305 // &GetElement(node)->Right
306 (new Regex(@"ref ([a-zA-Z0-9]+)\\((([a-zA-Z0-9\\*]+)\\)\\.([a-zA-Z0-9]+)"),
→ "&$1($2)->$3", 0),
307 // GetElement(node).Right
308 // GetElement(node)->Right
309 (new Regex(@"([a-zA-Z0-9]+)\\((([a-zA-Z0-9\\*]+)\\)\\.([a-zA-Z0-9]+)"), "$1($2)->$3", 0),
310 // [Fact]npublic: static void SizeBalancedTreeMultipleAttachAndDetachTest()
311 // public: TEST_METHOD(SizeBalancedTreeMultipleAttachAndDetachTest)
312 (new Regex(@"\\[Fact\\] \\s\\n+(public:)?(static)?void ([a-zA-Z0-9]+)\\(\\)"), "public:
→ TEST_METHOD($3)", 0),
313 // class TreesTests
314 // TEST_CLASS(TreesTests)
315 (new Regex(@"class ([a-zA-Z0-9]+Tests)"), "TEST_CLASS($1)", 0),
316 // Assert.Equal
317 // Assert::AreEqual
318 (new Regex(@"(?<type>Assert)\\. (?<method>(Not)?Equal)"), "${type}::Are${method}", 0),
319 // Assert.Throws
320 // Assert::ExpectException
321 (new Regex(@"(Assert)\\.Throws"), "$1::ExpectException", 0),
322 // Assert.True
323 // Assert::IsTrue
324 (new Regex(@"(Assert)\\. (True|False)"), "$1::Is$2", 0),
325 // $"Argument {argumentName} is null."
326 // std::string("Argument
→ ").append(Platform::Converters::To<std::string>(argumentName)).append(" is
→ null.")
327 (new Regex(@"\\$""(?<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),
328 // $"
329 // "
330 (new Regex(@"\\$"""), "\\\"", 0),
331 // std::string(std::string("[").append(Platform::Converters::To<std::string>(Minimum)
→ )).append(",
→ ").append(Platform::Converters::To<std::string>(Maximum)).append("]")
332 // std::string("[").append(Platform::Converters::To<std::string>(Minimum)).append(",
→ ").append(Platform::Converters::To<std::string>(Maximum)).append("]")
333 (new Regex(@"std::string\\((?<begin>std::string\\(""\\\\"| [^""\\r\\n])*""\\)\\.append\\((Platf_
→ orm::Converters::To<std::string>\\((\\^\\n)+\\| [^\\n]+)\\)\\)\\)\\.append\\)",
→ "${begin}.append", 10),
334 // Console.WriteLine("...")
335 // printf("...\\n")
336 (new Regex(@"Console\\.WriteLine\\(""([^""\\r\\n]+)""\\)"), "printf(\\$1\\n\\n)", 0),
337 // TElement Root;
338 // TElement Root = 0;
339 (new Regex(@"(?<before>\\r?\\n[\\t ]+)(?<access>(private|protected|public)(:
→ )?)?(?<type>[a-zA-Z0-9:]+(?<!return)) (?<name>[_a-zA-Z0-9]+);"),
→ "${before}${access}${type} ${name} = 0;", 0),

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340 // TreeElement _elements[N];
341 // TreeElement _elements[N] = { {0} };
342 (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),
343 // auto path = new TElement[MaxPath];
344 // TElement path[MaxPath] = { {0} };
345 (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[$4] = { {0} };\"", 0),
346 // bool Equals(Range<T> other) { ... }
347 // bool operator ==(const Key &other) const { ... }
348 (new Regex(@"(?<before>\\r?\\n[\\t ]+bool )Equals\\((?<type>[\\t ]+
    ↳ (?<variable>[a-zA-Z0-9]+)\\)(?<after>(\\s|\\n)*\\)", "${before}operator ==(const
    ↳ ${type} &${variable}) const${after}", 0),
349 // Insert scope borders.
350 // class Range { ... public: override std::string ToString() { return ...; }
351 // class Range { /*~Range<T>~*/ ... public: override std::string ToString() { return
    ↳ ...; }
352 (new Regex(@"(?<classDeclarationBegin>\\r?\\n(?<indent>[\\t ]*)template <typename
    ↳ (?<typeParameter>[~<>\\n]+> (struct|class)
    ↳ (?<type>[a-zA-Z0-9]+<\\k<typeParameter>>)(\\s*:\\s*[~{\\n]+)?[\\t ]*(\\r?\\n)?[\\t
    ↳ ]*(?<middle>((?!class|struct)\\.\\n)+?)?(?<toStringDeclaration>(?!<access>(private|
    ↳ |protected|public): )override std::string ToString\\(\\))\"",
    ↳ "${classDeclarationBegin}/*~${type}~*/${middle}${toStringDeclaration}", 0),
353 // Inside the scope of ~!Range!~ replace:
354 // public: override std::string ToString() { return ...; }
355 // public: operator std::string() const { return ...; }\\n\\npublic: friend
    ↳ std::ostream & operator <<(std::ostream &out, const A &obj) { return out <<
    ↳ (std::string)obj; }
356 (new Regex(@"(?<scope>/\\s*(?<type>[a-zA-Z0-9<>:]+)~\\s*/)(?<separator>\\.\\n)(?<before>
    ↳ ((?!/\\s*~\\k<type>~\\s*/)(\\.\\n)*)?(?<toStringDeclaration>\\r?\\n(?<indent>[
    ↳ \\t]*)?(?<access>(private|protected|public): )override std::string ToString\\(\\)
    ↳ (?<toStringMethodBody>[~}\\n]+))\"", "${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
    ↳ ${type} &obj) { return out << (std::string)obj; }\"", 0),
357 // Remove scope borders.
358 // /*~Range~*/
359 //
360 (new Regex(@"/\\s*~[a-zA-Z0-9<>:]+~\\s*/", "", 0),
361 // private: inline static ConcurrentBag<std::exception> _exceptionsBag;
362 // private: inline static std::mutex _exceptionsBag_mutex; \\n\\n private: inline
    ↳ static std::vector<std::exception> _exceptionsBag;
363 (new Regex(@"(?<begin>\\r?\\n(?<indent>[\\t ]+))?(?<access>(private|protected|public):
    ↳ )?inline static ConcurrentBag<(?!<argumentType>[~;\\r\\n]+)>
    ↳ (?<name>[_a-zA-Z0-9]+);\"", "${begin}private: inline static std::mutex
    ↳ ${name}_mutex;" + Environment.NewLine + Environment.NewLine +
    ↳ "${indent}${access}inline static std::vector<${argumentType}> ${name};\"", 0),
364 // public: static IReadonlyCollection<std::exception> GetCollectedExceptions() {
    ↳ return _exceptionsBag; }
365 // public: static std::vector<std::exception> GetCollectedExceptions() { return
    ↳ std::vector<std::exception>(_exceptionsBag); }
366 (new Regex(@"(?<access>(private|protected|public): )?static
    ↳ IReadonlyCollection<(?!<argumentType>[~;\\r\\n]+)> (?<methodName>[_a-zA-Z0-9]+)\\(\\)
    ↳ { return (?<fieldName>[_a-zA-Z0-9]+); }\"", "${access}static
    ↳ std::vector<${argumentType}> ${methodName}() { return
    ↳ std::vector<${argumentType}>({${fieldName}}); }\"", 0),
367 // public: static event EventHandler<std::exception> ExceptionIgnored =
    ↳ OnExceptionIgnored; ... };
368 // ... public: static inline Platform::Delegates::MulticastDelegate<void(void*,
    ↳ const std::exception&> ExceptionIgnored = OnExceptionIgnored; };
369 (new Regex(@"(?<begin>\\r?\\n(\\r?\\n)?(?<halfIndent>[
    ↳ \\t]+)\\k<halfIndent>)(?<access>(private|protected|public): )?static event
    ↳ EventHandler<(?!<argumentType>[~;\\r\\n]+)> (?<name>[_a-zA-Z0-9]+) = (?<defaultDele
    ↳ gate>[_a-zA-Z0-9]+);(?<middle>(\\.\\n)+?)?(?<end>\\r?\\n\\k<halfIndent>});\"",
    ↳ "${middle}" + Environment.NewLine + Environment.NewLine +
    ↳ "${halfIndent}${halfIndent}${access}static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const ${argumentType}&>
    ↳ ${name} = ${defaultDelegate};${end}", 0),
370 // public: event Disposal OnDispose;
371 // public: Platform::Delegates::MulticastDelegate<Disposal> OnDispose;
372 (new Regex(@"(?<begin>(?!<access>(private|protected|public): )?(static )?)event
    ↳ (?<type>[a-zA-Z][:_a-zA-Z0-9]+) (?<name>[_a-zA-Z][_a-zA-Z0-9]+);\"",
    ↳ "${begin}Platform::Delegates::MulticastDelegate<${type}> ${name};\"", 0),
373 // Insert scope borders.

```



```

374 // class IgnoredExceptions { ... private: inline static std::vector<std::exception>
    ↳ _exceptionsBag;
375 // class IgnoredExceptions {/*~_exceptionsBag~*/ ... private: inline static
    ↳ std::vector<std::exception> _exceptionsBag;
376 (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]+);)"),
    ↳ "$${classDeclarationBegin}/*~${fieldName}~*/${middle}${vectorFieldDeclaration}",
    ↳ 0),
377 // Inside the scope of ~!_exceptionsBag!~ replace:
378 // _exceptionsBag.Add(exception);
379 // _exceptionsBag.push_back(exception);
380 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*/)(?<separator>.\|\n)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*/)(.\|\n))*?)\k<fieldName>\.Add"),
    ↳ "$${scope}${separator}${before}${fieldName}.push_back", 10),
381 // Remove scope borders.
382 // /*~_exceptionsBag~*/
383 //
384 (new Regex(@"/*~[_a-zA-Z0-9]+~\s*/"), "", 0),
385 // Insert scope borders.
386 // class IgnoredExceptions { ... private: static std::mutex _exceptionsBag_mutex;
387 // class IgnoredExceptions {/*~_exceptionsBag~*/ ... private: static std::mutex
    ↳ _exceptionsBag_mutex;
388 (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;);)"),
    ↳ "$${classDeclarationBegin}/*~${fieldName}~*/${middle}${mutexDeclaration}", 0),
389 // Inside the scope of ~!_exceptionsBag!~ replace:
390 // return std::vector<std::exception>(_exceptionsBag);
391 // std::lock_guard<std::mutex> guard(_exceptionsBag_mutex); return
    ↳ std::vector<std::exception>(_exceptionsBag);
392 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*/)(?<separator>.\|\n)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*/)(.\|\n))*?){(?<after>((?!lock_guard)[^{};\r\n])*\k<f
    ↳ ieldName>[~;}\r\n]*;)"}, "$${scope}${separator}${before}{
    ↳ std::lock_guard<std::mutex> guard($${fieldName}_mutex);$${after}", 10),
393 // Inside the scope of ~!_exceptionsBag!~ replace:
394 // _exceptionsBag.Add(exception);
395 // std::lock_guard<std::mutex> guard(_exceptionsBag_mutex); \r\n
    ↳ _exceptionsBag.Add(exception);
396 (new Regex(@"(?<scope>/\s*(?<fieldName>[_a-zA-Z0-9]+)~\s*/)(?<separator>.\|\n)(?<before>
    ↳ e>((?!/\s*\k<fieldName>~\s*/)(.\|\n))*?){(?<after>((?!lock_guard)([~{};]\|\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),
397 // Remove scope borders.
398 // /*~_exceptionsBag~*/
399 //
400 (new Regex(@"/*~[_a-zA-Z0-9]+~\s*/"), "", 0),
401 // Insert scope borders.
402 // class IgnoredExceptions { ... public: static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const std::exception&)>
    ↳ ExceptionIgnored = OnExceptionIgnored;
403 // class IgnoredExceptions {/*~ExceptionIgnored~*/ ... public: static inline
    ↳ Platform::Delegates::MulticastDelegate<void(void*, const std::exception&)>
    ↳ ExceptionIgnored = OnExceptionIgnored;
404 (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]+);)"),
    ↳ "$${classDeclarationBegin}/*~${name}~*/${middle}${eventDeclaration}", 0),
405 // Inside the scope of ~!ExceptionIgnored!~ replace:
406 // ExceptionIgnored.Invoke(NULL, exception);
407 // ExceptionIgnored(NULL, exception);
408 (new Regex(@"(?<scope>/\s*(?<eventName>[_a-zA-Z0-9]+)~\s*/)(?<separator>.\|\n)(?<before>
    ↳ >((?!/\s*\k<eventName>~\s*/)(.\|\n))*?)\k<eventName>\.Invoke"),
    ↳ "$${scope}${separator}${before}${eventName}", 10),
409 // Remove scope borders.
410 // /*~ExceptionIgnored~*/
411 //
412 (new Regex(@"/*~[_a-zA-Z0-9]+~\s*/"), "", 0),
413 // Insert scope borders.
414 // auto added = new StringBuilder();
415 // /*~sb~*/std::string added;

```

```

416 (new Regex(@"(auto|(System\.Text\.)?StringBuilder) (?<variable>[a-zA-Z0-9]+) = new
    ↳ (System\.Text\.)?StringBuilder\(\);"), "/~*${variable}~/std::string
    ↳ ${variable};", 0),
417 // static void Indent(StringBuilder sb, int level)
418 // static void Indent(/*~sb~/StringBuilder sb, int level)
419 (new Regex(@"(?<start>, |\) (System\.Text\.)?StringBuilder
    ↳ (?<variable>[a-zA-Z0-9]+) (?<end>, |\)"), "${start}/*~*${variable}~/std::string&
    ↳ ${variable}${end}", 0),
420 // Inside the scope of ~!added!~ replace:
421 // sb.ToString()
422 // sb
423 (new Regex(@"(?<scope>/\~* (?<variable>[a-zA-Z0-9]+) ~\~*\/) (?<separator>.\|\\n) (?<before>
    ↳ ((?!/\~*~\k<variable>~\~*\/)(.\|\\n))*?) \k<variable>\.ToString\(\)"),
    ↳ "${scope}${separator}${before}${variable}", 10),
424 // sb.AppendLine(argument)
425 // sb.append(Platform::Converters::To<std::string>(argument)).append(1, '\\n')
426 (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),
427 // sb.Append('\\t', level);
428 // sb.append(level, '\\t');
429 (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),
430 // sb.Append(argument)
431 // sb.append(Platform::Converters::To<std::string>(argument))
432 (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),
433 // Remove scope borders.
434 // /*~sb~/
435 //
436 (new Regex(@"/*~*[a-zA-Z0-9]+~\~*/"), "", 0),
437 // Insert scope borders.
438 // auto added = new HashSet<TElement>();
439 // ~!added!~std::unordered_set<TElement> added;
440 (new Regex(@"auto (?<variable>[a-zA-Z0-9]+) = new
    ↳ HashSet<(?<element>[a-zA-Z0-9]+)>\(\);"),
    ↳ "~!${variable}!~std::unordered_set<${element}> ${variable};", 0),
441 // Inside the scope of ~!added!~ replace:
442 // added.Add(node)
443 // added.insert(node)
444 (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),
445 // Inside the scope of ~!added!~ replace:
446 // added.Remove(node)
447 // added.erase(node)
448 (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(${argument})", 10),
449 // if (added.insert(node)) {
450 // if (!added.contains(node)) { added.insert(node);
451 (new Regex(@"if \\((?<variable>[a-zA-Z0-9]+)\\.insert\\((?<argument>[a-zA-Z0-9]+)\\)\\) (?
    ↳ <separator>[\\t ]*[\\r\\n]+) (?<indent>[\\t ]*){", "if
    ↳ (!${variable}.contains(${argument})) ${separator}${indent}{ " +
    ↳ Environment.NewLine + "${indent}    ${variable}.insert(${argument});", 0),
452 // Remove scope borders.
453 // ~!added!~
454 //
455 (new Regex(@"~![a-zA-Z0-9]+!~"), "", 5),
456 // Insert scope borders.
457 // auto random = new System::Random(0);
458 // std::srand(0);
459 (new Regex(@"[a-zA-Z0-9\\.]+ ([a-zA-Z0-9]+) = new
    ↳ (System::)?Random\\((([a-zA-Z0-9]+)\\)");", "~!$1!~std::srand($3);", 0),
460 // Inside the scope of ~!random!~ replace:
461 // random.Next(1, N)
462 // (std::rand() % N) + 1

```

```

463 (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}) +
    ↳ ${from}", 10),
464 // Remove scope borders.
465 // ~!random!~
466 //
467 (new Regex(@"~![a-zA-Z0-9]+!~"), "", 5),
468 // Insert method body scope starts.
469 // void PrintNodes(TElement node, StringBuilder sb, int level) {
470 // void PrintNodes(TElement node, StringBuilder sb, int level) { /*method-start*/
471 (new Regex(@"(?<start>\r?\n[\\t ]+)(?<prefix>((private|protected|public): )?(virtual
    ↳ )?[a-zA-Z0-9:_]+
    ↳ )?(?<method>[a-zA-Z][a-zA-Z0-9]*\\((?<arguments>[^\|\\])*\\)(?<override>(
    ↳ override)?)(?<separator>[\\t\\r\\n\\s]*\\)((?<end>[~])")", "${start}${prefix}${method}
    ↳ (${arguments})${override}${separator}{ /*method-start*/${end}",
    ↳ 0),
472 // Insert method body scope ends.
473 // { /*method-start*/...}
474 // { /*method-start*/... /*method-end*/}
475 (new Regex(@"{ /\*method-start\*/ (?<body>((?<bracket>\\{) | (?<-bracket>\\}) | [^\{\\}]*)+ )
    ↳ \\}"), "{ /*method-start*/${body} /*method-end*/",
    ↳ 0),
476 // Inside method bodies replace:
477 // GetFirst(
478 // this->GetFirst(
479 (new
    ↳ Regex(@"(?<scope>\/\*method-start\*/)(?<before>((?!\/\*method-end\*/)(.\|\\n))*?) (?
    ↳ <separator>[\\W](?!(:|\\.|->|throw\\s+)))(?<method>(?!sizeof)[a-zA-Z0-9]+)\\((?!\\
    ↳ \\{)(?<after>(.\|\\n))*?) (?<scopeEnd>\/\*method-end\*/)",
    ↳ "${scope}${before}${separator}this->${method}(${after}${scopeEnd}", 100),
480 // Remove scope borders.
481 // /*method-start*/
482 //
483 (new Regex(@"\/\*method-(start|end)\\s\/")", "", 0),
484 // Insert scope borders.
485 // const std::exception& ex
486 // const std::exception& ex/*~ex~*/
487 (new Regex(@"(?<before>\\(| )(?<variableDefinition>(const )?(std::)?exception&?
    ↳ (?<variable>[_a-zA-Z0-9]+)) (?<after>\\W)"),
    ↳ "${before}${variableDefinition}/*~${variable}~*/${after}", 0),
488 // Inside the scope of ~!ex!~ replace:
489 // ex.Message
490 // ex.what()
491 (new Regex(@"(?<scope>\/\*~(?<variable>[_a-zA-Z0-9]+)~\*/)(?<separator>.\|\\n)(?<before>
    ↳ >((?!\/\*~\k<variable>~\*/)(.\|\\n))*?) (Platform::Converters::To<std::string>\\(\k<
    ↳ variable>\\.Message\\) | \k<variable>\\.Message)"),
    ↳ "${scope}${separator}${before}${variable}.what()", 10),
492 // Remove scope borders.
493 // /*~ex~*/
494 //
495 (new Regex(@"\/\*~[_a-zA-Z0-9]+~\*/")", "", 0),
496 // throw ObjectDisposedException(objectName, message);
497 // throw std::runtime_error(std::string("Attempt to access disposed object
    ↳ ").append(objectName).append(": ").append(message).append("."));
498 (new Regex(@"throw ObjectDisposedException\\((?<objectName>[a-zA-Z_][a-zA-Z0-9_]*),
    ↳ (?<message>[a-zA-Z0-9_]*[Mm]essage[a-zA-Z0-9_]*\\(\\|\\)?| [a-zA-Z_][a-zA-Z0-9_]*\\)\\)
    ↳ ;")", "throw std::runtime_error(std::string(\"Attempt to access disposed object
    ↳ \").append(${objectName}).append(\" : \").append(${message}).append(\".\"));",
    ↳ 0),
499 // throw ArgumentNullException(argumentName, message);
500 // throw std::invalid_argument(std::string("Argument
    ↳ ").append(argumentName).append(" is null: ").append(message).append("."));
501 (new Regex(@"throw
    ↳ ArgumentNullException\\((?<argument>[a-zA-Z]*[Aa]rgument[a-zA-Z]*),
    ↳ (?<message>[a-zA-Z]*[Mm]essage[a-zA-Z]*\\(\\|\\)?\\)\\)";", "throw
    ↳ std::invalid_argument(std::string(\"Argument \").append(${argument}).append(\"
    ↳ is null: \").append(${message}).append(\".\"));", 0),
502 // throw ArgumentException(message, argumentName);
503 // throw std::invalid_argument(std::string("Invalid ").append(argumentName).append("
    ↳ argument: ").append(message).append("."));
504 (new Regex(@"throw
    ↳ ArgumentException\\((?<message>[a-zA-Z]*[Mm]essage[a-zA-Z]*\\(\\|\\)?),
    ↳ (?<argument>[a-zA-Z]*[Aa]rgument[a-zA-Z]*\\)\\)";", "throw
    ↳ std::invalid_argument(std::string(\"Invalid \").append(${argument}).append(\"
    ↳ argument: \").append(${message}).append(\".\"));", 0),

```

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505 // throw ArgumentOutOfRangeException(argumentName, argumentValue, messageBuilder());
506 // 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("."););
507 (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),
508 // throw NotSupportedException();
509 // throw std::logic_error("Not supported exception.");
510 (new Regex(@"throw NotSupportedException\(\);)", "throw std::logic_error(\"Not
    ↳ supported exception.\");", 0),
511 // throw NotImplementedException();
512 // throw std::logic_error("Not implemented exception.");
513 (new Regex(@"throw NotImplementedException\(\);)", "throw std::logic_error(\"Not
    ↳ implemented exception.\");", 0),
514 // Insert scope borders.
515 // const std::string& message
516 // const std::string& message/*~message~/
517 (new Regex(@"(?<before>\(|\s)(?<variableDefinition>(const\s)?((std::)?string&?|char\*)
    ↳ (?<variable>[_a-zA-Z0-9]+)))(?<after>\W)",
    ↳ "${before}${variableDefinition}/*~${variable}~/${after}", 0),
518 // Inside the scope of /*~message~/ replace:
519 // Platform::Converters::To<std::string>(message)
520 // message
521 (new Regex(@"(?<scope>\/\s*(?<variable>[_a-zA-Z0-9]+)~\s*)(?<separator>.\|\n)(?<before>
    ↳ >((?!\/\s*\k<variable>~\s*)(.\|\n))*?)Platform::Converters::To<std::string>\(\k<v
    ↳ ariable>\)", "${scope}${separator}${before}${variable}",
    ↳ 10),
522 // Remove scope borders.
523 // /*~ex~/
524 //
525 (new Regex(@"\/\s*[_a-zA-Z0-9]+~\s\/", "", 0),
526 // Insert scope borders.
527 // std::tuple<T, T> tuple
528 // std::tuple<T, T> tuple/*~tuple~/
529 (new Regex(@"(?<before>\(|\s)(?<variableDefinition>(const\s)?(std::)?tuple<[^\n]+&?
    ↳ (?<variable>[_a-zA-Z0-9]+)))(?<after>\W)",
    ↳ "${before}${variableDefinition}/*~${variable}~/${after}", 0),
530 // Inside the scope of ~!ex!~ replace:
531 // tuple.Item1
532 // std::get<1-1>(tuple)
533 (new Regex(@"(?<scope>\/\s*(?<variable>[_a-zA-Z0-9]+)~\s*)(?<separator>.\|\n)(?<before>
    ↳ >((?!\/\s*\k<variable>~\s*)(.\|\n))*?)\k<variable>\.Item(?<itemNumber>\d+)(?<afte
    ↳ r>\W)",
    ↳ "${scope}${separator}${before}std::get<${itemNumber}-1>(${variable})${after}",
    ↳ 10),
534 // Remove scope borders.
535 // /*~ex~/
536 //
537 (new Regex(@"\/\s*[_a-zA-Z0-9]+~\s\/", "", 0),
538 // Insert scope borders.
539 // class Range<T> {
540 // class Range<T> {/*~type~Range<T>~/
541 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)(template\s*<[^\<>\n]*>
    ↳ )?(struct|class)
    ↳ (?<fullType>(?(<typeName>[a-zA-Z0-9]+)(<[^\n]*>)?)(\s*:\s*[^\n]+)?[\t
    ↳ ]*(\r?\n)?[\t ]*{)"),
    ↳ "${classDeclarationBegin}/*~type~${typeName}~${fullType}~/", 0),
542 // Inside the scope of /*~type~Range<T>~/ insert inner scope and replace:
543 // public: static implicit operator std::tuple<T, T>(Range<T> range)
544 // public: operator std::tuple<T, T>() const {/*~variable~Range<T>~/
545 (new Regex(@"(?<scope>\/\s*~type~(?<typeName>[^\n]*+)(?<fullType>[^\n]*+~\s\/)(?<
    ↳ separator>.\|\n)(?<before>((?!\/\s*~type~\k<typeName>~\k<fullType>~\s\/)(.\|\n))*?)
    ↳ (?<access>(private|protected|public): )static implicit operator
    ↳ (?<targetType>[^\n]*+)\(((?<argumentDeclaration>\k<fullType>
    ↳ (?<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:

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547 // 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)); }
548 // public: Range(std::tuple<T, T> tuple) : Range(std::get<1-1>(tuple),
    ↳ std::get<2-1>(tuple)) { }
549 (new Regex(@"(?<scope>\/\~type~(?<typeName>[~\n\*]+)~(?<fullType>[~\n\*]+)~\*/)(?<
    ↳ separator>.\n)(?<before>((?!\/\~type~\k<typeName>~\k<fullType>~\*/)(.\n))*?) (
    ↳ ?<access>(private|protected|public): )static implicit operator
    ↳ (\k<fullType>|\k<typeName>)\((?<arguments>[~\n\*]+)\)(\s|\n)*{(\s|\n)*return
    ↳ (new )?(\k<fullType>|\k<typeName>)\((?<passedArguments>[~\n\*]+)\);(\s|\n)*"}),
    ↳ "${scope}${separator}${before}${access}${typeName}(${arguments}) :
    ↳ ${typeName}(${passedArguments}) { }", 10),
550 // Inside the scope of /*~variable~range~/ replace:
551 // range.Minimum
552 // this->Minimum
553 (new Regex(@"(?<scope>{\/\~variable~(?<variable>[~\n\*]+)~\*/)(?<separator>.\n)(?<be
    ↳ fore>(?(beforeExpression>(?(bracket>{)|(?(<-bracket>})|[\~{}]\n)*?)\k<variable>\.
    ↳ (?(field>[_a-zA-Z0-9]+)(?<after>(,|;|}|
    ↳ |\\))?(?<afterExpression>(?(bracket>{)|(?(<-bracket>})|[\~{}]\n)*?)") ,
    ↳ "${scope}${separator}${before}this->${field}${after}", 10),
554 // Remove scope borders.
555 // /*~ex~/
556 //
557 (new Regex(@"\/\~[~\n\*]+[~\n\*]+~\*/"), "", 0),
558 // Insert scope borders.
559 // namespace Platform::Ranges { ... }
560 // namespace Platform::Ranges {/*~start~namespace~Platform::Ranges~/ ...
    ↳ /*~end~namespace~Platform::Ranges~/}
561 (new Regex(@"(?<namespaceDeclarationBegin>\r?\n(?<indent>[\t ]*)namespace
    ↳ (?<namespaceName>(?(namePart>[a-zA-Z][a-zA-Z0-9]+)(?(nextNamePart>:[a-zA-Z][a-z
    ↳ A-Z0-9]+))(\s|\n)*)(?(middle>(\n\*)?(?<end>(?(<=\r?\n)\k<indent>}{?!;))") ,
    ↳ "${namespaceDeclarationBegin}/*~start~namespace~${namespaceName}~/${middle}/*~e
    ↳ nd~namespace~${namespaceName}~/${end}",
    ↳ 0),
562 // Insert scope borders.
563 // class Range<T> { ... };
564 // class Range<T> {/*~start~type~Range<T>~T~/ ... /*~end~type~Range<T>~T~/};
565 (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\*)?(?<end>(?(<=\r?\n)\k<indent>){?!;}))") ,
    ↳ "${classDeclarationBegin}/*~start~type~${type}~${typeParameter}~/${middle}${end}
    ↳ Indent}/*~end~type~${type}~${typeParameter}~/${end}",
    ↳ 0),
566 // Inside the scope replace:
567 // /*~start~namespace~Platform::Ranges~/ ... /*~start~type~Range<T>~T~/ ...
    ↳ public: override std::int32_t GetHashCode() { return {Minimum,
    ↳ Maximum}.GetHashCode(); } ... /*~end~type~Range<T>~T~/ ...
    ↳ /*~end~namespace~Platform::Ranges~/
568 // /*~start~namespace~Platform::Ranges~/ ... /*~start~type~Range<T>~T~/ ...
    ↳ /*~end~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(); } }; }
569 (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\(\)(\s|\n)*{(\s*(?<methodBody>[~\n\*]+[~\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),
570 // Inside scope of /*~start~method~/ replace:
571 // /*~start~method~/ ... Minimum ... /*~end~method~/
572 // /*~start~method~/ ... obj.Minimum ... /*~end~method~/

```

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573 (new Regex(@"(?<methodScopeStart>/\/*~start~method~\/*) (?<before>.+({|,
    ↳ )) (?<name>[a-zA-Z] [a-zA-Z0-9]+) (?<after>[^\n\.\(a-zA-Z0-9] ((?!/\/*~end~method~\/*|
    ↳ ) [^\n])+) (?<methodScopeEnd>/\/*~end~method~\/*)"),
    ↳ "$${methodScopeStart}${before}obj.$${name}$${after}$${methodScopeEnd}", 10),
574 // Remove scope borders.
575 // /\/*~start~type~Range<T>~\/*/
576 //
577 (new Regex(@"\/\/*~[^\*\n]+(~[^\*\n]+)*~\/*/" , "" , 0),
578 // class Disposable<T> : public Disposable
579 // class Disposable<T> : public Disposable<>
580 (new Regex(@"(?<before>(struct|class) (?<type>[a-zA-Z] [a-zA-Z0-9]*)<[^\<>\n]+> :
    ↳ (?<access>(private|protected|public) ) ?\k<type> (?<after>\b(?:\<)>)",
    ↳ "$${before}<>${after}", 0),
581 // Insert scope borders.
582 // class Disposable<T> : public Disposable<> { ... };
583 // class Disposable<T> : public Disposable<>
    ↳ {/\/*~start~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/ ...
    ↳ /\/*~end~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/};
584 (new Regex(@"(?<classDeclarationBegin>\r?\n(?<indent>[\t ]*)template[\t
    ↳ ]*(?<typeParameters>[^\n]*)>[\t ]*(struct|class) [\t
    ↳ ]+(?<fullType>(?(type>[a-zA-Z] [a-zA-Z0-9]*)<[^\<>\n]*>?) [\t ]*:[\t
    ↳ ]*(?(access>(private|protected|public) [\t
    ↳ ]+)?(?(fullBaseType>(?(baseType>[a-zA-Z] [a-zA-Z0-9]*)<[^\<>\n]*>?) [\t
    ↳ ]*(\r?\n)?[\t
    ↳ ]*{) (?(middle>(.|\n)*) (?<beforeEnd>(?(=>\r?\n)\k<indent>) (?<end>};)"))",
    ↳ "$${classDeclarationBegin}/\/*~start~type~${type}~${fullType}~${baseType}~${fullBas
    ↳ eType}~*/$${middle}$${beforeEnd}/\/*~end~type~${type}~${fullType}~${baseType}~${full
    ↳ BaseType}~*/$${end}",
    ↳ 0),
585 // Inside the scope replace:
586 // /\/*~start~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/ ... ) : base(
    ↳ ... /\/*~end~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/
587 // /\/*~start~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/ ... ) :
    ↳ Disposable<>( /\/*~end~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/
588 (new Regex(@"(?<before>(?(typeScopeStart>/\/*~start~type~(?(types>(?(type>[^\n\*]+)~
    ↳ ) (?<fullType>[^\n\*]+)~\k<type>~(?(fullBaseType>[^\n\*]+)~\k<types>~\/*/)(.|\n)+?)\s*:\s
    ↳ )base(?(after>\((.|\n)+?(?(typeScopeEnd>/\/*~end~type~\k<types>~\/*/)))",
    ↳ "$${before}$${fullBaseType}$${after}", 20),
589 // Inside the scope replace:
590 // /\/*~start~type~Disposable~Disposable<T>~X~X<>~\/*/ ... ) : base( ...
    ↳ /\/*~end~type~Disposable~Disposable<T>~X~X<>~\/*/
591 // /\/*~start~type~Disposable~Disposable<T>~X~X<>~\/*/ ... ) : X(
    ↳ /\/*~end~type~Disposable~Disposable<T>~X~X<>~\/*/
592 (new Regex(@"(?<before>(?(typeScopeStart>/\/*~start~type~(?(types>(?(type>[^\n\*]+)~
    ↳ ) (?<fullType>[^\n\*]+)~(?(baseType>[^\n\*]+)~(?(fullBaseType>[^\n\*]+)~\k<types>~\/*/)(.
    ↳ |\n)+?)\s*:\s)base(?(after>\((.|\n)+?(?(typeScopeEnd>/\/*~end~type~\k<types>~\/*/
    ↳ )))", "$${before}$${baseType}$${after}",
    ↳ 20),
593 // Inside the scope replace:
594 // /\/*~start~type~Disposable~Disposable<T>~X~X<>~\/*/ ... public: Disposable(T object)
    ↳ { Object = object; }... public: Disposable(T object) : Disposable(object) { }
    ↳ ... /\/*~end~type~Disposable~Disposable<T>~X~X<>~\/*/
595 // /\/*~start~type~Disposable~Disposable<T>~X~X<>~\/*/ ... public: Disposable(T object)
    ↳ { Object = object; } /\/*~end~type~Disposable~Disposable<T>~X~X<>~\/*/
596 (new Regex(@"(?<before>(?(typeScopeStart>/\/*~start~type~(?(types>(?(type>[^\n\*]+)~
    ↳ ) (?<fullType>[^\n\*]+)~(?(baseType>[^\n\*]+)~(?(fullBaseType>[^\n\*]+)~\k<types>~\/*/)(.
    ↳ |\n)+?(?(constructor>(?(access>(private|protected|public) : [\t
    ↳ ]*) ?\k<type>\k<arguments>[^\n\*]+)\s*{[^\n\*]+}) (|\n)+?) (?(duplicateConstru
    ↳ ctor>(?(access>(private|protected|public) : [\t
    ↳ ]*) ?\k<type>\k<arguments>)\s*{[^\n\*]+}\s*{[^\n\*]+}) (?(after>(.|\n)+?(?(typeS
    ↳ copeEnd>/\/*~end~type~\k<types>~\/*/)))", "$${before}$${after}",
    ↳ 20),
597 // Remove scope borders.
598 // /\/*~start~type~Disposable~Disposable<T>~Disposable~Disposable<>~\/*/
599 //
600 (new Regex(@"\/\/*~[^\*\n]+(~[^\*\n]+)*~\/*/" , "" , 0),
601 // Insert scope borders.
602 // private: inline static const AppDomain _currentDomain = AppDomain.CurrentDomain;
603 // private: inline static const AppDomain _currentDomain =
    ↳ AppDomain.CurrentDomain; /\/*~app-domain~_currentDomain~\/*/
604 (new Regex(@"(?<declaration>(?(access>(private|protected|public) : [\t ]*)?(inline[\t
    ↳ ]+)?(static[\t ]+)?(const[\t ]+)?AppDomain[\t
    ↳ ]+(?(field>[a-zA-Z] [a-zA-Z0-9]*) [\t ]*=[\t ]*AppDomain\.CurrentDomain;))",
    ↳ "$${declaration}/\/*~app-domain~${field}~\/*/" , 0),

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```
// Inside the scope replace:
// /*~app-domain~_currentDomain~/ ... _currentDomain.ProcessExit += OnProcessExit;
// /*~app-domain~_currentDomain~/ ... std::atexit(OnProcessExit);
(new Regex(@"(?<before>(?(fieldScopeStart)/\~*app-domain~(?(field)[~\n\*]+)~\*/)(.|
    \n)+?)\k<field>\.ProcessExit[\t ]*\+=[\t
    ]*(?(eventHandler>[a-zA-Z_][a-zA-Z0-9_]*)");), "${before}std::atexit(${eventHandl
    er});/*~process-exit-handler~${eventHandler}~*/",
    20),
// Inside the scope replace:
// /*~app-domain~_currentDomain~/ ... _currentDomain.ProcessExit -= OnProcessExit;
// /*~app-domain~_currentDomain~/ ... /* No translation. It is not possible to
    unsubscribe from std::atexit. */
(new Regex(@"(?<before>(?(fieldScopeStart)/\~*app-domain~(?(field)[~\n\*]+)~\*/)(.|
    \n)+?r?\n[\t ]*\k<field>\.ProcessExit[\t ]*\-=[\t
    ]*(?(eventHandler>[a-zA-Z_][a-zA-Z0-9_]*)");), "${before}/* No translation. It is
    not possible to unsubscribe from std::atexit. */", 20),
// Inside the scope replace:
// /*~process-exit-handler~OnProcessExit~/ ... static void OnProcessExit(void
    *sender, EventArgs e)
// /*~process-exit-handler~OnProcessExit~/ ... static void OnProcessExit()
(new Regex(@"(?<before>(?(fieldScopeStart)/\~*process-exit-handler~(?(handler)[~\n\
    *]+)~\*/)(.| \n)+?static[\t ]+void[\t ]+\k<handler>\(\[~()\n]+\)\)", "${before}"),
    20),
// Remove scope borders.
// /*~app-domain~_currentDomain~/
//
(new Regex(@"\/\~*[~\*\n]+(~[~\*\n]+)*~\*/"), "", 0),
// AppDomain.CurrentDomain.ProcessExit -= OnProcessExit;
// /* No translation. It is not possible to unsubscribe from std::atexit. */
(new Regex(@"AppDomain\.CurrentDomain\.ProcessExit -= ([a-zA-Z_][a-zA-Z0-9_]*)");),
    "/* No translation. It is not possible to unsubscribe from std::atexit. */", 0),
}.Cast<ISubstitutionRule>().ToList();

public static readonly IList<ISubstitutionRule> LastStage = new List<SubstitutionRule>
{
    // IDisposable disposable)
    // IDisposable &disposable)
    (new Regex(@"(?<argumentAbstractType>I[A-Z][a-zA-Z0-9]+(<[^>\r\n]+>)?)
        (?<argument>[_a-zA-Z0-9]+)(?<after>,|\))", "${argumentAbstractType}
        &${argument}${after}", 0),
    // ICounter<int, int> c1;
    // ICounter<int, int>* c1;
    (new Regex(@"(?<abstractType>I[A-Z][a-zA-Z0-9]+(<[^>\r\n]+>)?)
        (?<variable>[_a-zA-Z0-9]+)(?<after> = null)?";), "${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
    //
```

```

657 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)new\
    ↪ s+"), "${before}",
    ↪ 10),
658 // x == null
659 // x == nullptr
660 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)(?<v
    ↪ ariable>[_a-zA-Z][_a-zA-Z0-9]+)(?<operator>\s*(==|!=)\s*)null(?<after>\W)"),
    ↪ "${before}${variable}${operator}nullptr${after}", 10),
661 // null
662 // {}
663 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)null
    ↪ (?<after>\W)"), "${before}{}${after}",
    ↪ 10),
664 // default
665 // 0
666 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)defa
    ↪ ult(?<after>\W)"), "${before}0${after}",
    ↪ 10),
667 // object x
668 // void *x
669 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)(?<!
    ↪ @)(object|System\.Object) (?<after>\w)"), "${before}void *${after}",
    ↪ 10),
670 // <object>
671 // <void*>
672 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)(?<!
    ↪ @)(object|System\.Object) (?<after>\W)"), "${before}void*${after}",
    ↪ 10),
673 // @object
674 // object
675 (new Regex(@"@([_a-zA-Z0-9]+)"), "$1", 0),
676 // this->GetType().Name
677 // typeid(this).name()
678 (new Regex(@"(this->GetType\(\)\.Name)", "typeid($1).name()", 0),
679 // ArgumentException
680 // std::invalid_argument
681 (new Regex(@"(?<before>\r?\n[~""\r\n]*(""(\\"""|["""\r\n])*""[~""\r\n])*")(?<=\W)(Sys
    ↪ tem\.)?ArgumentNullException(?<after>\W)"),
    ↪ "${before}std::invalid_argument${after}", 10),
682 // InvalidOperationException
683 // std::runtime_error
684 (new Regex(@"(\W)(InvalidOperationException|Exception)(\W)"),
    ↪ "$1std::runtime_error$3", 0),
685 // ArgumentException
686 // std::invalid_argument
687 (new Regex(@"(\W)(ArgumentException|ArgumentOutOfRangeException)(\W)"),
    ↪ "$1std::invalid_argument$3", 0),
688 // template <typename T> struct Range : IEquatable<Range<T>>
689 // template <typename T> struct Range {
690 (new Regex(@"(?<before>template <typename (?<typeParameter>[^\n]+)> (struct|class)
    ↪ (?<type>[_a-zA-Z0-9]+<[^\n]+>)) : (public
    ↪ )?IEquatable<\k<type>>(?<after>(\s|\n)*{)"), "${before}${after}", 0),
691 // public: delegate void Disposal(bool manual, bool wasDisposed);
692 // public: delegate void Disposal(bool, bool);
693 (new Regex(@"(?<before>(?<access>(private|protected|public): )delegate
    ↪ (?<returnType>[_a-zA-Z][_a-zA-Z0-9:]+)
    ↪ (?<delegate>[_a-zA-Z][_a-zA-Z0-9:]+)\(((?<leftArgumentType>[_a-zA-Z][_a-zA-Z0-9:]+)
    ↪ )*(?<argumentType>[_a-zA-Z][_a-zA-Z0-9:]+)
    ↪ (?<argumentName>[_a-zA-Z][_a-zA-Z0-9:]+)(?<after>(,
    ↪ (?<rightArgumentType>[_a-zA-Z][_a-zA-Z0-9:]+)
    ↪ (?<rightArgumentName>[_a-zA-Z][_a-zA-Z0-9:]+))*\);)"),
    ↪ "${before}${argumentType}${after}", 20),
694 // public: delegate void Disposal(bool, bool);
695 // using Disposal = void(bool, bool);
696 (new Regex(@"(?<access>(private|protected|public): )delegate
    ↪ (?<returnType>[_a-zA-Z][_a-zA-Z0-9:]+)
    ↪ (?<delegate>[_a-zA-Z][_a-zA-Z0-9:]+)\(((?<argumentTypes>[^\(\)\n]*\)\);)", "using
    ↪ ${delegate} = ${returnType}(${argumentTypes});", 20),
697 // <4-1>
698 // <3>
699 (new Regex(@"(?<before><)4-1(?<after>>)", "${before}3${after}", 0),
700 // <3-1>
701 // <2>
702 (new Regex(@"(?<before><)3-1(?<after>>)", "${before}2${after}", 0),
703 // <2-1>
704 // <1>

```

```

705         (new Regex(@"(?<before><)2-1(?<after>>)", "${before}1${after}", 0),
706         // <1-1>
707         // <0>
708         (new Regex(@"(?<before><)1-1(?<after>>)", "${before}0${after}", 0),
709         // #region Always
710         //
711         (new Regex(@"(^\r?\n)[ \t]*#(region|endregion)[^\r\n]*(\r?\n|$)", "", 0),
712         // //define ENABLE_TREE_AUTO_DEBUG_AND_VALIDATION
713         //
714         (new Regex(@"\\\/[ \t]*#define[ \t]+[_a-zA-Z0-9]+[ \t]*"), "", 0),
715         // #if USEARRAYPOOL\r\n#endif
716         //
717         (new Regex(@"#if [a-zA-Z0-9]+\s+endif", "", 0),
718         // [Fact]
719         //
720         (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),
721         // \A \n ... namespace
722         // \Anamespace
723         (new Regex(@"(\A)(\r?\n)+namespace", "$1namespace", 0),
724         // \A \n ... class
725         // \Aclass
726         (new Regex(@"(\A)(\r?\n)+class", "$1class", 0),
727         // \n\n\n
728         // \n\n
729         (new Regex(@"\r?\n[ \t]*\r?\n[ \t]*\r?\n"), Environment.NewLine +
→      Environment.NewLine, 50),
730         // {\n\n
731         // {\n
732         (new Regex(@"{[ \t]*\r?\n[ \t]*\r?\n"), "{" + Environment.NewLine, 10),
733         // \n\n}
734         // \n}
735         (new Regex(@"\r?\n[ \t]*\r?\n(?<end>[ \t]*)"), Environment.NewLine + "${end}", 10),
736     }.Cast<ISubstitutionRule>().ToList();
737
738     public CSharpToCppTransformer(IList<ISubstitutionRule> extraRules) :
→      base(FirstStage.Concat(extraRules).Concat>LastStage).ToList()) { }
739
740     public CSharpToCppTransformer() : base(FirstStage.Concat>LastStage).ToList()) { }
741 }
742 }

```

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
35     var transformer = new CSharpToCppTransformer();
36     var actualResult = transformer.Transform(helloWorldCode);
37     Assert.Equal(expectedResult, actualResult);
38 }
39 }
```

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