

The Dreaming Machine Fixes Bugs Overnight

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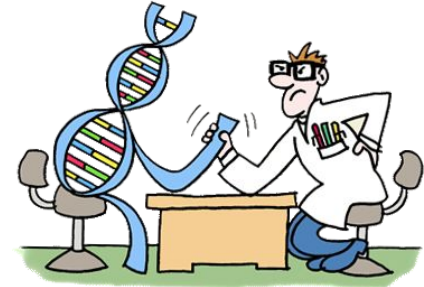
*University of Stirling
°Janus Rehabilitation

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Bug Fixing



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96   <div class="carousel">
97     <ol>
98       <li>One more for good measure.</li>
99     </ol>
100   </div>
101   <a class="left carousel-control" href="#myCarousel" role="button" data-slide="prev">
102     <span class="glyphicon glyphicon-chevron-left" aria-hidden="true">>
103     <span class="sr-only">Previous</span>
104   </a>
105   <a class="right carousel-control" href="#myCarousel" role="button" data-slide="next">
106     <span class="glyphicon glyphicon-chevron-right" aria-hidden="true">>
107     <span class="sr-only">Next</span>
108   </a>
109 </div></-- .carousel -->
110
111 <!-- Featured Content Section -->
112 <div class="container">
113   <div class="row">
114     <div class="col-md-4"> FEATURED CONTENT </div>
115     <div class="col-md-4"></div>
116   </div>

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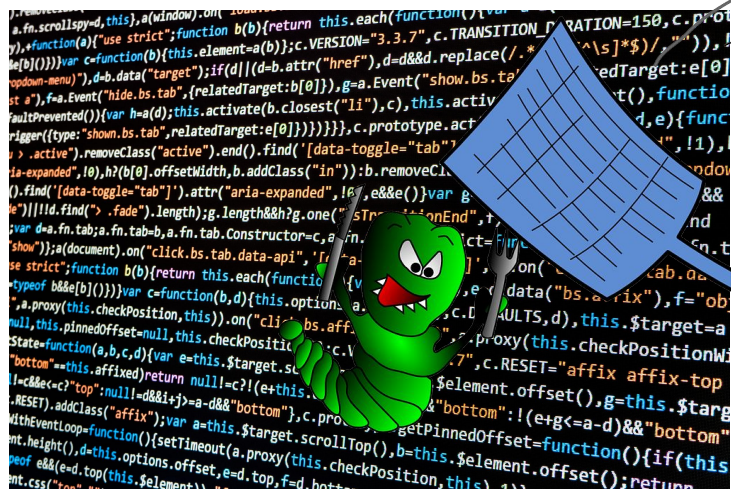
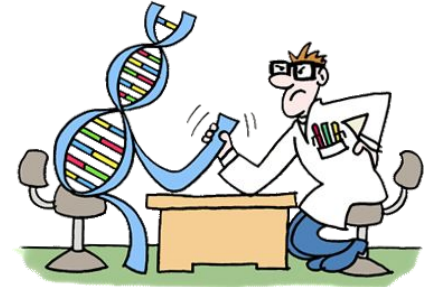
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    y),function(a){"use strict";function b(b){return this.each(function(){var
    le[b]()}}var c=function(b){this.element=a(b)};c.VERSION="3.3.7",c.TRANSITION_DURATION=150,c.pro
    pdown-menu")},d-b.data("target");if(d||(d=b.attr("href"),d=d&&d.replace(/.*(?:#\w+)$/),"")),f
    st a",f-a.Event("hide.bs.tab",{relatedTarget:b[0]}),g-a.Event("show.bs.tab",{relatedTarget:e[0]
    }> .active",h,h.parent(),function(b,d,e){function f(f){return this.each(function(){var
    trigger({type:"shown.bs.tab",relatedTarget:e[0]}))}}},c.prototype.activate=function(b,d,e){f
    faultPrevented()({var h=a(d);this.activate(b.closest("li"),c),this.activate(h,h.parent(),f
    nger({type:"shown.bs.tab",relatedTarget:e[0]}))}}},c.prototype.activate=function(b,d,e){f
    e)||!d.find("> .fade").length);g.length&&g.one("bsTransitionEnd",f).emulateTransitionEnd
    var d=a.fn.tab;var a.fn.tab=b,a.fn.tab.Constructor=c,a.fn.tab.noConflict=function(){return a.fn.t
    se strict";function b(b){return this.each(function(){var d=a(this),e=d.data("bs.affix"),f="ob
    ,a.proxy(this.checkPosition(),c.DEFAULTS,d),this.$target=a
    null,this.pinnedOffset=null,this.checkPosition();c.VERSION="3.3.7",c.RESET="affix affix-top
    State=function(a,b,c,d){var e=this.$target;this.checkPosition();c.VERSION="3.3.7",c.RESET="
    "bottom"==e.hasClass("top")?null:c.affix=="bottom"?null:c.affix=="top"?null:c.affix=="bottom"
    .RESET).addClass("affix");var a=this.$target,c.prototype.getPinnedOffset=function(){if(this
    .thventLoop=function(){setInterval(a.proxy(this.scrollTop(),b=this.$element.offset(),return
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    .offset().top);return

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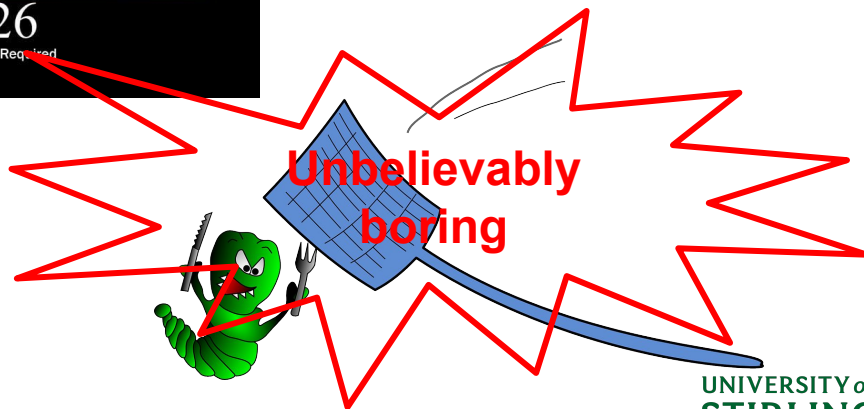
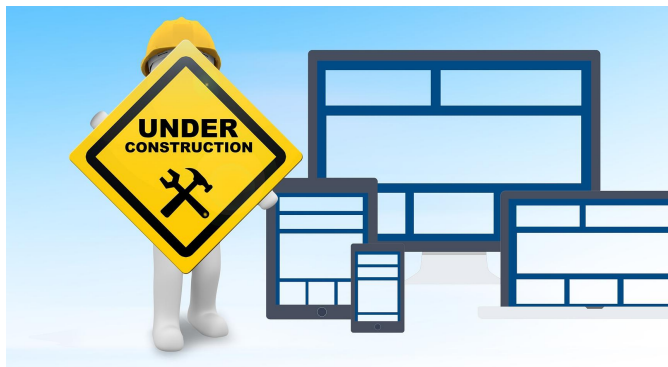
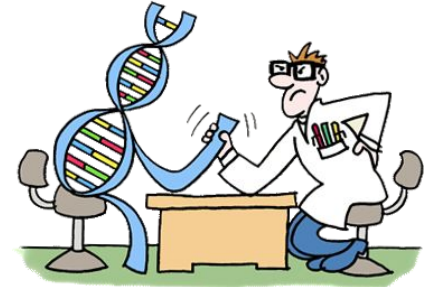


Bug Fixing - Ugh!



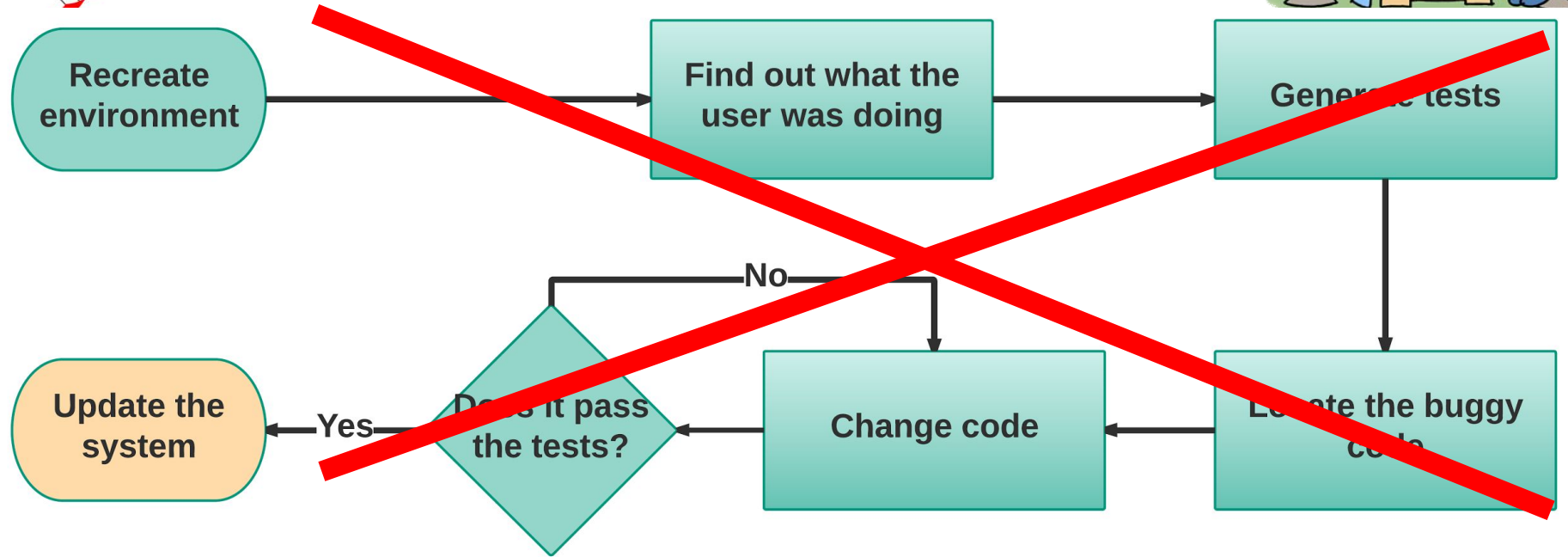
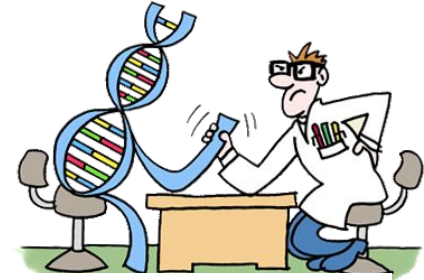


What is the problem?



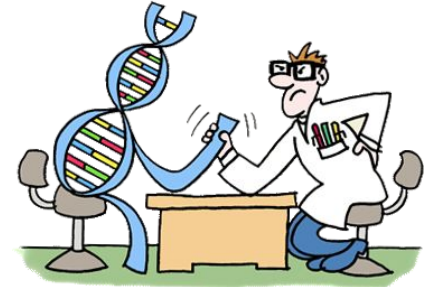


What is the problem?

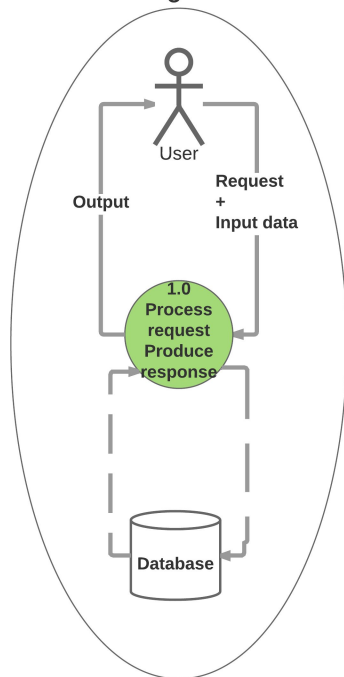




What is the solution?



Daytime Management

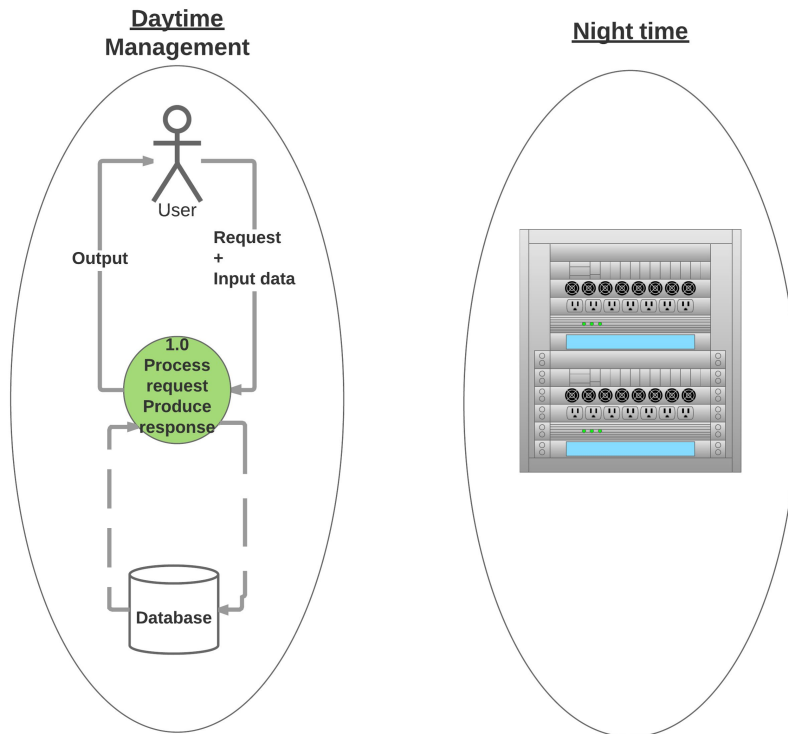
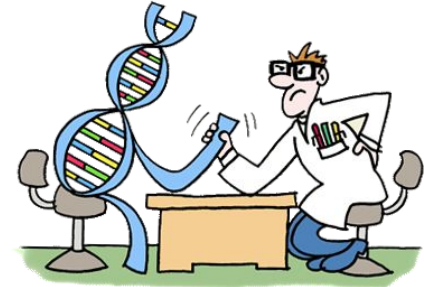


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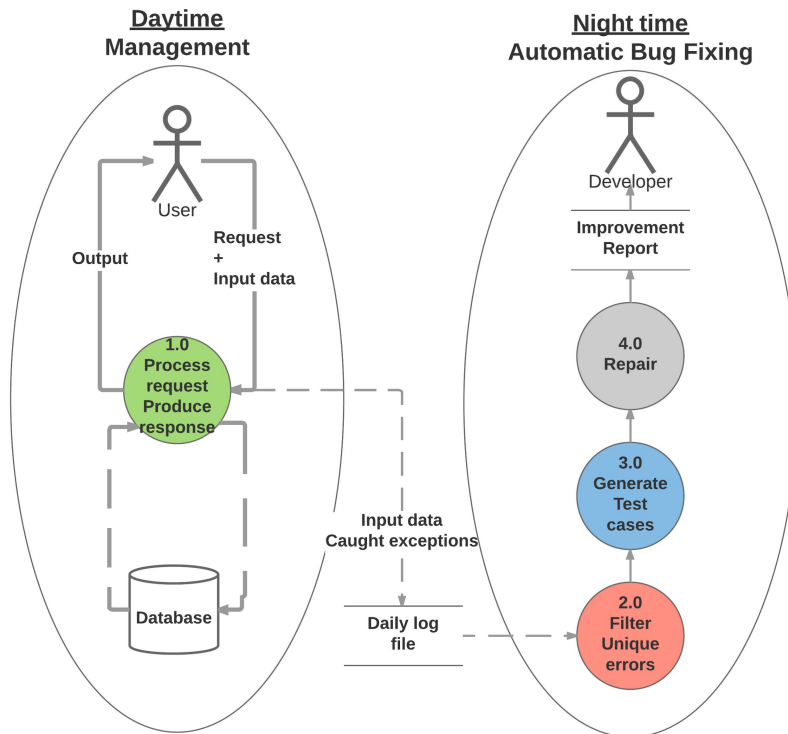
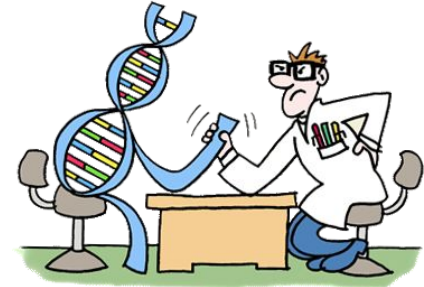


What is the solution?



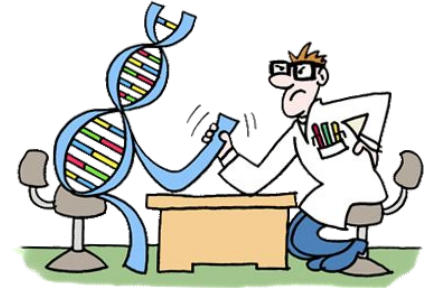


What is the solution?





Why is this human competitive?



- (E) The result is equal to or better than the most recent human-created solution to a long-standing problem for which there has been a succession of increasingly better human-created solutions.
- (G) The result solves a problem of indisputable difficulty in its field.

Fixing Bugs in Your Sleep: How Genetic Improvement Became an Overnight Success

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ABSTRACT

We present a bespoke live system in commercial use with self-improving capability. During daytime business hours it provides an overview and control for many specialists to simultaneously schedule and observe the rehabilitation process for multiple clients. However, in the evening, after the last user logs out, it starts a self-analysis based on the day's recorded interactions. It generates test data from the recorded interactions for Genetic Improvement to fix any recorded bugs that have raised exceptions. The system has already been under test for over 6 months and has in that time identified, located, and fixed 22 bugs. No other bugs have been identified by other methods during that time. It demonstrates the effectiveness of simple test data generation and the ability of GI for

1 INTRODUCTION

Genetic Improvement (GI) [38] is a growing area within Search Based Software Engineering (SBSE) [23, 24] which uses computational search methods to improve existing software. Despite its growth within academic research the practical usage of GI has not yet followed. Like with many SBSE applications, the software industry needs an incubation period for new ideas where they come to trust in outcomes and see those ideas as cost effective solutions. GI is in the ideal position to shorten that period for the latter as it presents a considerable cost decrease for the software life cycle's often most expensive part: maintenance [18, 34]. There are examples of software improved by GI being used and publicly available [31] which is impressive considering how young GI is as a

The Use of Automatic Test Data Generation for Genetic Improvement in a Live System

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Abstract—In this paper we present a bespoke live system in commercial use that has been implemented with self-improving properties. During business hours it provides overview and control for many specialists to simultaneously schedule and observe the rehabilitation process for multiple clients. However in the evening, after the last user logs out, it starts a self-analysis based on the day's recorded interactions and the self-improving process. It uses Search Based Software Testing (SBST) techniques to generate test data for Genetic Improvement (GI) to fix any bugs if exceptions have been recorded. The system has already been under testing for 4 months and demonstrates the effectiveness of simple test data generation and the power of GI for improving live code.

Keywords—Search Based Software Engineering; Test data generation; Bug fixing; Real world application

the product. It is a bespoke program for a vocational rehabilitation centre, developed and maintained by Janus Rehabilitation Centre in Reykjavik, Iceland.

The remainder of the paper is structured as follows. Section II lists some related work and inspirations. Section III details what the system does during business hours and how it keeps records for later generating test data. Section IV explains how the daily data is used to generate and utilise test data and Section V summarises the current data gathered since the launch of JM. Section VI gives an overview of what future directions we are currently contemplating.

II. RELATED WORK

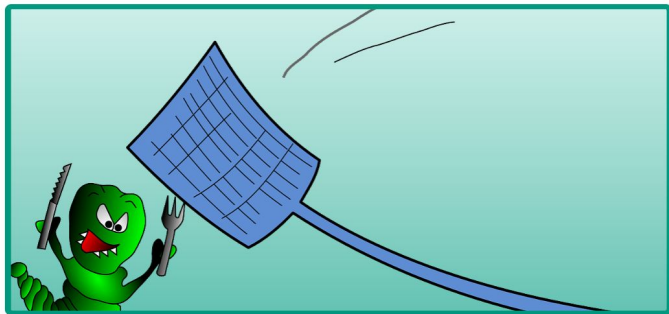
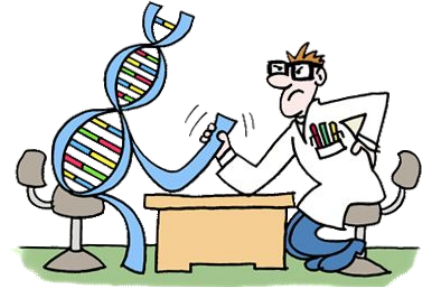


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Why is this human competitive? (E)

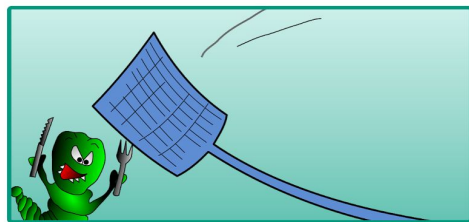
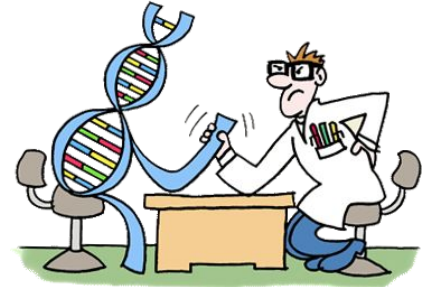


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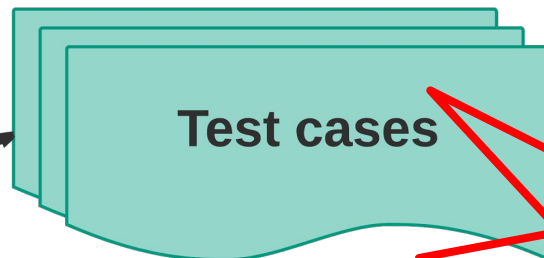
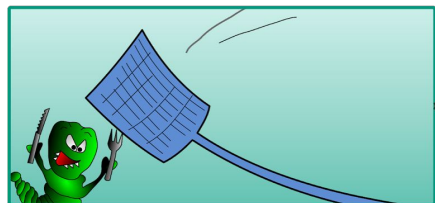
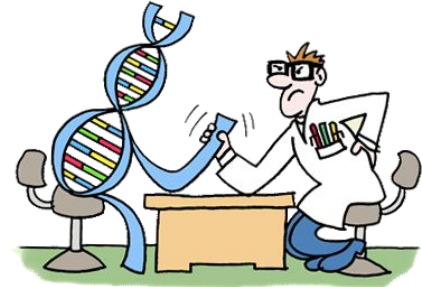


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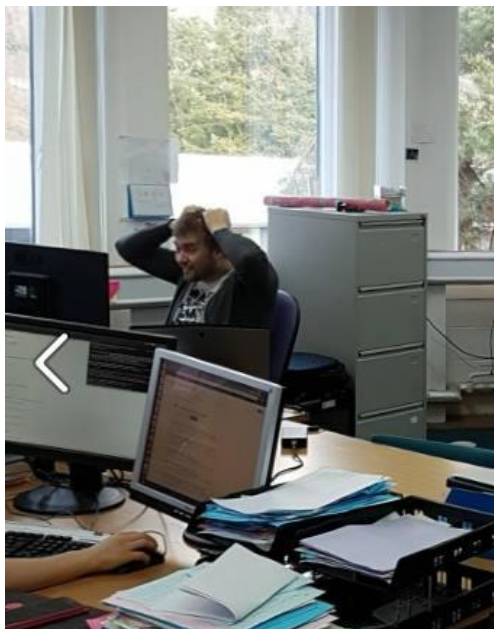
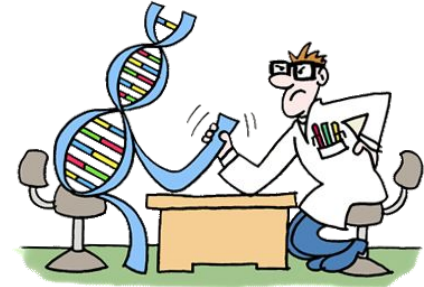


**22 bugs fixed
Overnight!**





Why is this human competitive? (G)

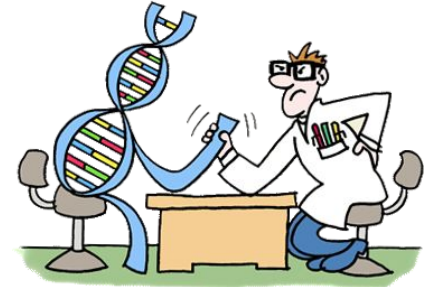


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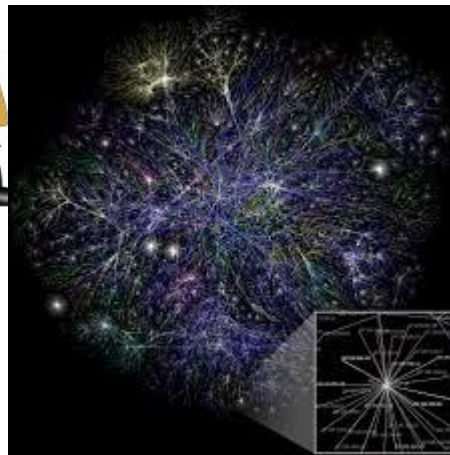
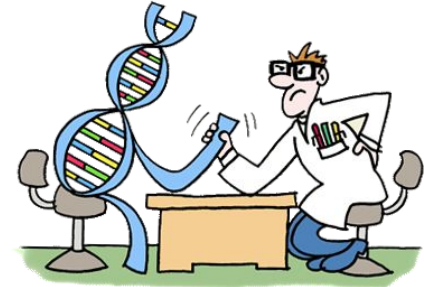


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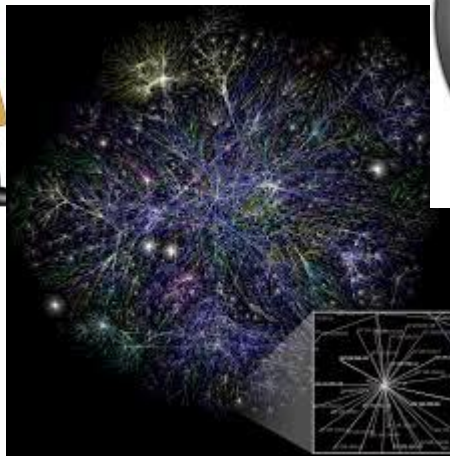
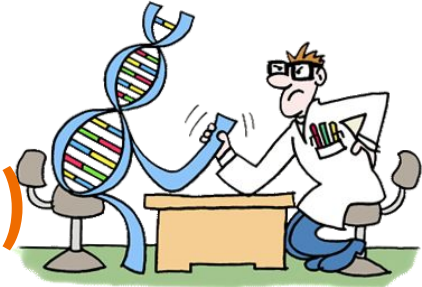


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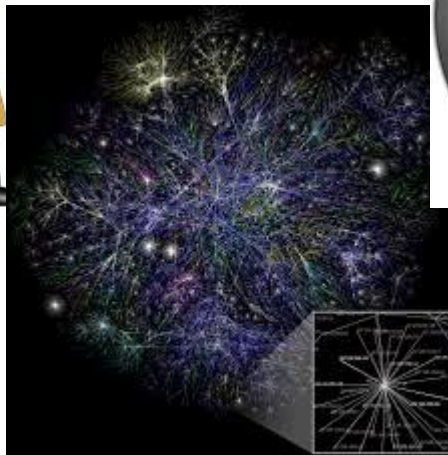
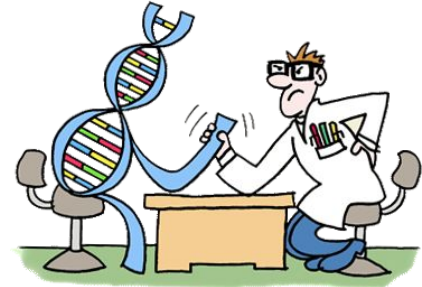


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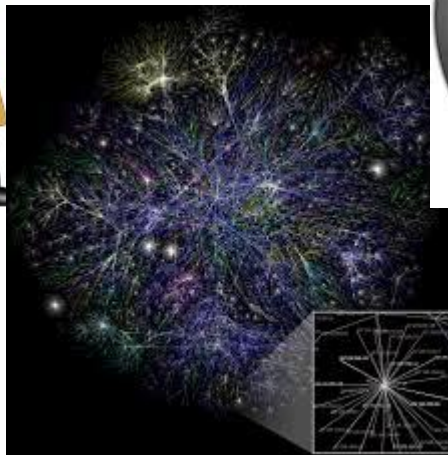
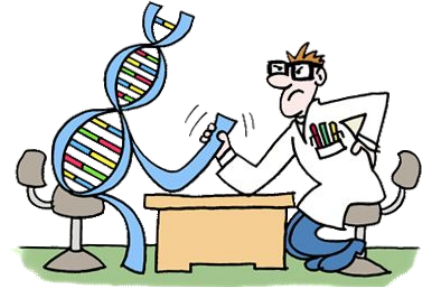


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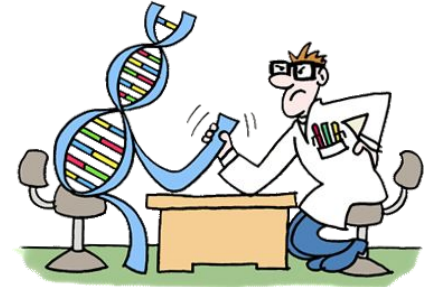


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Why is this best?



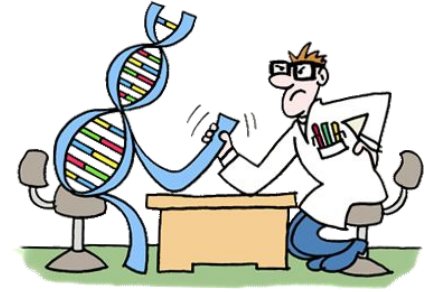
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- First ever example

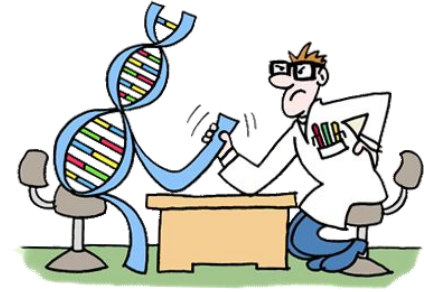
Why is this best?





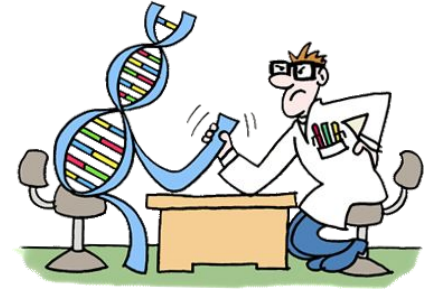
Why is this best?

- First ever example
- All bugs fixed overnight

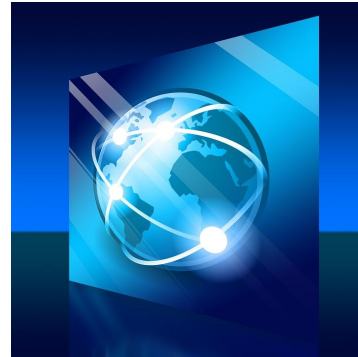




Why is this best?



- **First ever example**
- **All bugs fixed overnight**
- **Widespread impact**

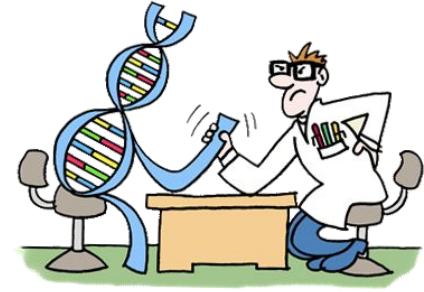


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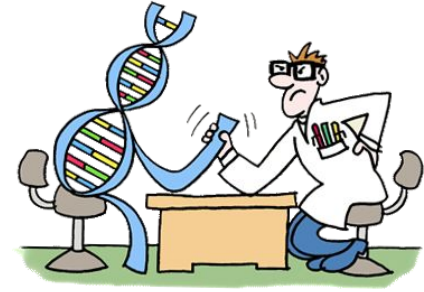


- First ever example
- All bugs fixed overnight
- Widespread impact
- Applicable to any software





Why is this best?



- First ever example
- All bugs fixed overnight
- Widespread impact
- Applicable to any software
- **Approved by domain experts and practitioners alike**

