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ISI (Dubai, UAE) = 0.829	PIHII (Russia) = 0.179	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 1.042	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 2.031	

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## SOME ERROR COMPUTER ALGEBRA SYSTEMS WHEN SOLVING SYSTEMS OF INEQUALITIES

**Abstract:** Discusses several cases of errors in the answers, when solving systems of inequalities in the system of computer algebra.

**Key words:** Computer algebra system, error, inequalities.

**Language:** English

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When solving systems of inequalities with application of computer algebra systems there are some errors that lead to incorrect results in the response. Consider the basic command for solving inequalities.

The command `solve ()` is used to solve inequalities and systems of inequalities in real numbers exactly the same as for solving equations and systems of equations [1-5]. The answer is expressed either as a set of inequalities, either through function `RealRange ()` and `Open ()`. The first

specifies a closed interval of real numbers, and the second is used to specify that the boundary point is not included in the constructed solution. To specify the solution as a set, should be set as a set of either inequality or unknown, regarding which the decision is searched. If this is not done, then the answer will be obtained using these functions in determining the actual intervals.

Example solution of inequalities:

```
> solve ((x+3)/(4-x)>4, x);  
  
solve ((x+3)/(4-x)>4, {x});  
  
solve (log[1/2] (log[2] (x^2-8)) >=-1);  
  
solve ({log[1/2] (log[2] (x^2-8)) >=-1});
```

$$\text{RealRange}\left(\text{Open}\left(\frac{13}{5}\right), \text{Open}(4)\right)$$
$$\left\{\frac{13}{5} < x, x < 4\right\}$$
$$\text{RealRange}(-2\sqrt{3}, 2\sqrt{3})$$
$$\{-2\sqrt{3} \leq x, x \leq 2\sqrt{3}\}$$

In this example, solved two inequalities, for each of which the solution is constructed as a set and in the form of real intervals. As observed there is no

problem. Now consider several systems of equations [6-10].

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```
> solve(5*x>10, x);
```

```
RealRange(Open(2), ∞)
```

```
> solve(5*x>=10, x);
```

```
RealRange(2, ∞)
```

```
> solve(ln(x)>2, x);
```

```
RealRange(Open(e2), ∞)
```

```
> solve(exp(x)>10, x);
```

```
RealRange(Open(ln(10)), ∞)
```

```
> solve(a*x>b, {x});
```

$$\left(-\text{signum}(a) x < -\frac{\text{signum}(a) b}{a}\right)$$

```
> eqns:=abs(z)^2/(z+1)<exp(2)/(exp(1)-1);
```

$$\text{eqns} := \frac{|z|^2}{z+1} < \frac{e^2}{e-1}$$

```
> solve(eqns, {z});
```

$$\left\{ z < \frac{1}{2} \frac{e^2 + \sqrt{(e^2)^2 + 4e^2e - 4e^2}}{e-1}, \frac{1}{2} \frac{e^2 - \sqrt{(e^2)^2 + 4e^2e - 4e^2}}{e-1} < z \right\}, (z < -1)$$

```
> eqns:=exp(x)*x^2>=1/2;
```

$$\text{eqns} := \frac{1}{2} \leq e^x x^2$$

```
> solve(eqns, {x});
```

$$\left(2 \text{LambertW}\left(-1, -\frac{1}{4}\sqrt{2}\right) \leq x, x \leq 2 \text{LambertW}\left(-\frac{1}{4}\sqrt{2}\right)\right), \left(2 \text{LambertW}\left(\frac{1}{4}\sqrt{2}\right) \leq x\right)$$

```
> eqns:=abs((z+abs(z+2))^2-1)^2=9;
```

$$\text{eqns} := |(z+|z+2|)^2 - 1|^2 = 9$$

```
> solve(eqns, {z});
```

```
(z=0), (z≤-2)
```

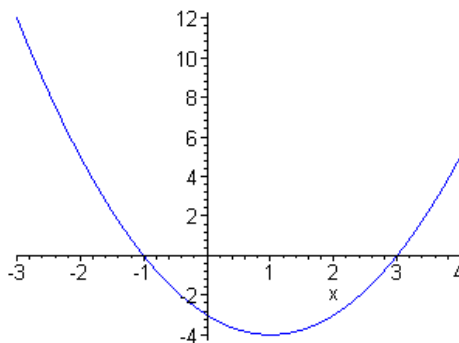
```
> evalf(%);
```

```
(z=0.), (z≤-2.)
```

```
solve(x^2-2*x-3>0, x);
```

```
RealRange(-∞, Open(-1)), RealRange(Open(3), ∞)
```

```
plot(x^2-2*x-3, x=-3..4, color=blue);
```



```
> solve(eqns, {x, y});
```

$$\left(-1 \leq y, y \leq 1, x + y < \frac{1}{2}, -1 < x, x < 1\right)$$

```
> solve({x*y*z>0, x>-1, y+z>10}, {x, y, z});
```

```
(z=0, -1 < x, 10 < y), (-1 < x, y=0, 10 < z)
```

As observed there is no problem. Define the system of inequalities:

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```
> restart;
d1:=2*x-5<=0;
d2:=x*x-5*x+6<=0;
d3:=x*x-5*x+6>=0;
d4:=2*x-5>=0;
r1:=evalf(solve({d1,d2},x));
r2:=evalf(solve({d3,d4},x));
```

$$d1 = 2x - 5 \leq 0$$

$$d2 = x^2 - 5x + 6 \leq 0$$

$$d3 = 0 \leq x^2 - 5x + 6$$

$$d4 = 0 \leq 2x - 5$$

$$r1 = \{2. \leq x, x \leq 2.500000000\}$$

$$r2 = \{3. \leq x\}$$

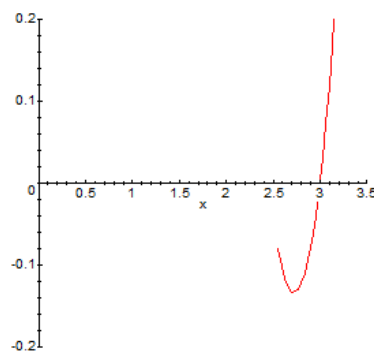
Solve the system of inequalities:

```
> solve((x*x-5*x+6)*sqrt(2*x-5)>=0,x);
solve((x*x-5*x+6)*sqrt(2*x-5)<=0,x);
r:=(x*x-5*x+6)*(2*x-5)^(1/2);
plot(r,x=0..3.5,y=-0.2..0.2);
```

$$\text{RealRange}(-\infty, 2), \text{RealRange}\left(2, \frac{5}{2}\right), \text{RealRange}(3, \infty)$$

$$\text{RealRange}(-\infty, 2), \text{RealRange}\left(2, \frac{5}{2}\right), \text{RealRange}\left(\frac{5}{2}, 3\right)$$

$$r = (x^2 - 5x + 6)\sqrt{2x - 5}$$



Observed for the first system of inequalities is the appearance of two gaps identifying where in reality function can not exist.

$$\text{RealRange}(-\infty, 2), \text{RealRange}\left(2, \frac{5}{2}\right),$$

$$\text{RealRange}(-\infty, 2), \text{RealRange}\left(2, \frac{5}{2}\right),$$

For the second system of inequalities observed a similar situation.

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