

# 1 test\_binop — MIR Walkthrough

**Purpose:** TODO: Describe why this walkthrough exists

## 1.1 Source Context

```
fn test_binop(x:i32, y:i32) -> () {
    // Arithmetic
    // Addition
    assert!(x + y == 52);
    assert!(52 == x + y);
    assert!(x + y == y + x);

    // Subtraction
    assert!(x - y == 32);
    assert!(y - x == -32);
    assert!(y - x != x - y);

    // Multiplication
    assert!(x * y == 420);
    assert!(x * -y == -420);
    assert!(-x * y == -420);
    assert!(-x * -y == 420);

    // Division
    // assert!(420 / 10 == 42); // FAILING SEE div.rs and div.mir

    // Modulo
    // assert!(x % 10 == 2); // FAILING SEE modulo.rs and modulo.mir

    // Bitwise
    // Xor
    assert!(1 ^ 2 == 3);
    assert!(1 ^ 3 == 2);

    // Or
    assert!(1 | 2 == 3);
    assert!(1 | 3 == 3);

    // And
    assert!(1 & 2 == 0);
    assert!(1 & 3 == 1);

    // // Shl
    assert!(2 << 1 == 4);
    // assert!(-128_i8 << 1 == 0); FAILS SEE shl_min.rs and shl_min.mir
    // assert!(-32768_i16 << 1 == 0); FAILS SEE shl_min.rs and shl_min.mir
    // assert!(-2147483648_i32 << 1 == 0); FAILS SEE shl_min.rs and shl_min.mir
    // assert!(-9223372036854775808_i64 << 1 == 0); FAILS SEE shl_min.rs and shl_min.mir
    // assert!(-17014118346046923173168730371588410572_i128 << 1 == 0); FAILS SEE shl_min.rs and
    shl_min.mir

    // // Shr
    assert!(2 >> 1 == 1);
    assert!(3 >> 1 == 1);
    assert!(1 >> 1 == 0);

    // Comparisons
    // Less Then
    assert!(x < x + y);
```

```

// Less Then or Equal
assert!(x <= x + y);
assert!(x <= x + y - y);

// Greater Then
assert!(x + y > x);

// Greater Then or Equal
assert!(x + y >= x);
assert!(x + y - y >= x);
}

```

## 1.2 Function Overview

- **Function:** test\_binop
- **Basic blocks:** 81
- **Return type:** () (0 bytes, align 1)
- **Notable properties:**
  - Contains panic path
  - Uses checked arithmetic
  - Contains assertions
  - Has conditional branches

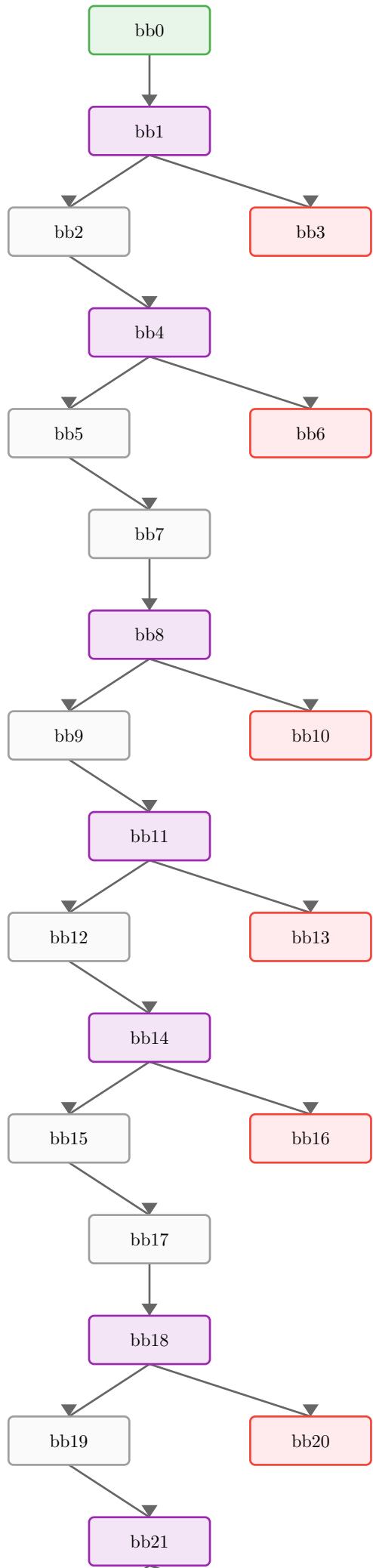
## 1.3 Locals

Local	Type	Notes
0	() (0 bytes, align 1)	Return place
1	Int(I32)	
2	Int(I32)	
3	Int(I32)	
4	(i32, bool) (8 bytes, align 4)	
5	()	
6	Int(I32)	
7	(i32, bool) (8 bytes, align 4)	
8	()	
9	Bool	
10	Int(I32)	
11	(i32, bool) (8 bytes, align 4)	
12	Int(I32)	
13	(i32, bool) (8 bytes, align 4)	
14	()	
15	Int(I32)	
16	(i32, bool) (8 bytes, align 4)	
17	()	
18	Int(I32)	
19	(i32, bool) (8 bytes, align 4)	
20	()	
21	Bool	
22	Int(I32)	
23	(i32, bool) (8 bytes, align 4)	
24	Int(I32)	

25	(i32, bool) (8 bytes, align 4)	
26	()	
27	Int(I32)	
28	(i32, bool) (8 bytes, align 4)	
29	()	
30	Int(I32)	
31	Int(I32)	
32	Bool	
33	(i32, bool) (8 bytes, align 4)	
34	()	
35	Int(I32)	
36	Int(I32)	
37	Bool	
38	(i32, bool) (8 bytes, align 4)	
39	()	
40	Int(I32)	
41	Int(I32)	
42	Bool	
43	Int(I32)	
44	Bool	
45	(i32, bool) (8 bytes, align 4)	
46	()	
47	Int(I32)	
48	()	
49	Int(I32)	
50	()	
51	Int(I32)	
52	()	
53	Int(I32)	
54	()	
55	Int(I32)	
56	()	
57	Int(I32)	
58	()	
59	Int(I32)	
60	Uint(U32)	
61	Bool	
62	()	
63	Int(I32)	
64	Uint(U32)	
65	Bool	
66	()	
67	Int(I32)	
68	Uint(U32)	
69	Bool	

70	()
71	Int(I32)
72	Uint(U32)
73	Bool
74	()
75	Bool
76	Int(I32)
77	(i32, bool) (8 bytes, align 4)
78	()
79	Bool
80	Int(I32)
81	(i32, bool) (8 bytes, align 4)
82	()
83	Bool
84	Int(I32)
85	Int(I32)
86	(i32, bool) (8 bytes, align 4)
87	(i32, bool) (8 bytes, align 4)
88	()
89	Bool
90	Int(I32)
91	(i32, bool) (8 bytes, align 4)
92	()
93	Bool
94	Int(I32)
95	(i32, bool) (8 bytes, align 4)
96	()
97	Bool
98	Int(I32)
99	Int(I32)
100	(i32, bool) (8 bytes, align 4)
101	(i32, bool) (8 bytes, align 4)
102	()

## 1.4 Control-Flow Overview



## 1.5 Basic Blocks

### 1.5.1 bb0 — entry

*Entry point of the function.*

MIR	Annotation
<code>_4 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _4.1 == false) → bb1</code>	Panic if move <code>_4.1</code> is true

### 1.5.2 bb1 — branch point

MIR	Annotation
<code>_3 = move _4.0</code>	Move value
<code>→ switch(move _3) [52→bb2; else→bb3]</code>	Branch on move <code>_3</code>

### 1.5.3 bb2

MIR	Annotation
<code>_7 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _7.1 == false) → bb4</code>	Panic if move <code>_7.1</code> is true

### 1.5.4 bb3 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _5 = panic([16 bytes])</code>	Call panic

### 1.5.5 bb4 — branch point

MIR	Annotation
<code>_6 = move _7.0</code>	Move value
<code>→ switch(move _6) [52→bb5; else→bb6]</code>	Branch on move <code>_6</code>

### 1.5.6 bb5

MIR	Annotation
<code>_11 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _11.1 == false) → bb7</code>	Panic if move <code>_11.1</code> is true

### 1.5.7 bb6 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _8 = panic([16 bytes])</code>	Call panic

### 1.5.8 bb7

MIR	Annotation
<code>_10 = move _11.0</code>	Move value
<code>_13 = checked(_2 + _1)</code>	Checked Add (may panic)
<code>→ assert(move _13.1 == false) → bb8</code>	Panic if move <code>_13.1</code> is true

### 1.5.9 bb8 — branch point

MIR	Annotation
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<code>_12 = move _13.0</code>	Move value
<code>_9 = move _10 == move _12</code>	Equal operation
<code>→ switch(move _9) [0→bb10; else→bb9]</code>	Branch on move _9

### 1.5.10 bb9

MIR	Annotation
<code>_16 = checked(_1 - _2)</code>	Checked Subtract (may panic)
<code>→ assert(move _16.1 == false) → bb11</code>	Panic if move _16.1 is true

### 1.5.11 bb10 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _14 = panic([16 bytes])</code>	Call panic

### 1.5.12 bb11 — branch point

MIR	Annotation
<code>_15 = move _16.0</code>	Move value
<code>→ switch(move _15) [32→bb12; else→bb13]</code>	Branch on move _15

### 1.5.13 bb12

MIR	Annotation
<code>_19 = checked(_2 - _1)</code>	Checked Subtract (may panic)
<code>→ assert(move _19.1 == false) → bb14</code>	Panic if move _19.1 is true

### 1.5.14 bb13 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _17 = panic([16 bytes])</code>	Call panic

### 1.5.15 bb14 — branch point

MIR	Annotation
<code>_18 = move _19.0</code>	Move value
<code>→ switch(move _18) [4294967264→bb15; else→bb16]</code>	Branch on move _18

### 1.5.16 bb15

MIR	Annotation
<code>_23 = checked(_2 - _1)</code>	Checked Subtract (may panic)
<code>→ assert(move _23.1 == false) → bb17</code>	Panic if move _23.1 is true

### 1.5.17 bb16 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _20 = panic([16 bytes])</code>	Call panic

### 1.5.18 bb17

MIR	Annotation
_22 = move _23.0	Move value
_25 = checked(_1 - _2)	Checked Subtract (may panic)
→ assert(move _25.1 == false) → bb18	Panic if move _25.1 is true

### 1.5.19 bb18 — branch point

MIR	Annotation
_24 = move _25.0	Move value
_21 = move _22 != move _24	Not equal operation
→ switch(move _21) [0→bb20; else→bb19]	Branch on move _21

### 1.5.20 bb19

MIR	Annotation
_28 = checked(_1 * _2)	Checked Multiply (may panic)
→ assert(move _28.1 == false) → bb21	Panic if move _28.1 is true

### 1.5.21 bb20 — panic path

*Panic/diverging path.*

MIR	Annotation
→ _26 = panic([16 bytes])	Call panic

### 1.5.22 bb21 — branch point

MIR	Annotation
_27 = move _28.0	Move value
→ switch(move _27) [420→bb22; else→bb23]	Branch on move _27

### 1.5.23 bb22

MIR	Annotation
_32 = _2 == -2147483648	Equal operation
→ assert(move _32 == false) → bb24	Panic if move _32 is true

### 1.5.24 bb23 — panic path

*Panic/diverging path.*

MIR	Annotation
→ _29 = panic([16 bytes])	Call panic

### 1.5.25 bb24

MIR	Annotation
_31 = -_2	Negation
_33 = checked(_1 * _31)	Checked Multiply (may panic)
→ assert(move _33.1 == false) → bb25	Panic if move _33.1 is true

### 1.5.26 bb25 — branch point

MIR	Annotation
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<code>_30 = move _33.0</code>	Move value
<code>→ switch(move _30) [4294966876-&gt;bb26; else-&gt;bb27]</code>	Branch on move <code>_30</code>

### 1.5.27 bb26

MIR	Annotation
<code>_37 = _1 == -2147483648</code>	Equal operation
<code>→ assert(move _37 == false) → bb28</code>	Panic if move <code>_37</code> is true

### 1.5.28 bb27 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _34 = panic([16 bytes])</code>	Call panic

### 1.5.29 bb28

MIR	Annotation
<code>_36 = -_1</code>	Negation
<code>_38 = checked(_36 * _2)</code>	Checked Multiply (may panic)
<code>→ assert(move _38.1 == false) → bb29</code>	Panic if move <code>_38.1</code> is true

### 1.5.30 bb29 — branch point

MIR	Annotation
<code>_35 = move _38.0</code>	Move value
<code>→ switch(move _35) [4294966876-&gt;bb30; else-&gt;bb31]</code>	Branch on move <code>_35</code>

### 1.5.31 bb30

MIR	Annotation
<code>_42 = _1 == -2147483648</code>	Equal operation
<code>→ assert(move _42 == false) → bb32</code>	Panic if move <code>_42</code> is true

### 1.5.32 bb31 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _39 = panic([16 bytes])</code>	Call panic

### 1.5.33 bb32

MIR	Annotation
<code>_41 = -_1</code>	Negation
<code>_44 = _2 == -2147483648</code>	Equal operation
<code>→ assert(move _44 == false) → bb33</code>	Panic if move <code>_44</code> is true

### 1.5.34 bb33

MIR	Annotation
<code>_43 = -_2</code>	Negation
<code>_45 = checked(_41 * _43)</code>	Checked Multiply (may panic)
<code>→ assert(move _45.1 == false) → bb34</code>	Panic if move <code>_45.1</code> is true

### 1.5.35 bb34 — branch point

MIR	Annotation
<code>_40 = move _45.0</code>	Move value
<code>→ switch(move _40) [420→bb35; else→bb36]</code>	Branch on move _40

### 1.5.36 bb35 — branch point

MIR	Annotation
<code>_47 = 1 ^ 2</code>	XOR operation
<code>→ switch(move _47) [3→bb37; else→bb38]</code>	Branch on move _47

### 1.5.37 bb36 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _46 = panic([16 bytes])</code>	Call panic

### 1.5.38 bb37 — branch point

MIR	Annotation
<code>_49 = 1 ^ 3</code>	XOR operation
<code>→ switch(move _49) [2→bb39; else→bb40]</code>	Branch on move _49

### 1.5.39 bb38 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _48 = panic([16 bytes])</code>	Call panic

### 1.5.40 bb39 — branch point

MIR	Annotation
<code>_51 = 1   2</code>	OR operation
<code>→ switch(move _51) [3→bb41; else→bb42]</code>	Branch on move _51

### 1.5.41 bb40 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _50 = panic([16 bytes])</code>	Call panic

### 1.5.42 bb41 — branch point

MIR	Annotation
<code>_53 = 1   3</code>	OR operation
<code>→ switch(move _53) [3→bb43; else→bb44]</code>	Branch on move _53

### 1.5.43 bb42 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _52 = panic([16 bytes])</code>	Call panic

### 1.5.44 bb43 — branch point

MIR	Annotation
<code>_55 = 1 &amp; 2</code>	AND operation
<code>→ switch(move _55) [0→bb45; else→bb46]</code>	Branch on move _55

### 1.5.45 bb44 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _54 = panic([16 bytes])</code>	Call panic

### 1.5.46 bb45 — branch point

MIR	Annotation
<code>_57 = 1 &amp; 3</code>	AND operation
<code>→ switch(move _57) [1→bb47; else→bb48]</code>	Branch on move _57

### 1.5.47 bb46 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _56 = panic([16 bytes])</code>	Call panic

### 1.5.48 bb47

MIR	Annotation
<code>_60 = 1 as RigidTy(Uint(U32))</code>	Integer conversion
<code>_61 = move _60 &lt; 32</code>	Less than operation
<code>→ assert(move _61 == true) → bb49</code>	Panic if move _61 is false

### 1.5.49 bb48 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _58 = panic([16 bytes])</code>	Call panic

### 1.5.50 bb49 — branch point

MIR	Annotation
<code>_59 = 2 &lt;&lt; 1</code>	Shift left operation
<code>→ switch(move _59) [4→bb50; else→bb51]</code>	Branch on move _59

### 1.5.51 bb50

MIR	Annotation
<code>_64 = 1 as RigidTy(Uint(U32))</code>	Integer conversion
<code>_65 = move _64 &lt; 32</code>	Less than operation
<code>→ assert(move _65 == true) → bb52</code>	Panic if move _65 is false

### 1.5.52 bb51 — panic path

*Panic/diverging path.*

MIR	Annotation
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<code>→ _62 = panic([16 bytes])</code>	Call panic
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### 1.5.53 bb52 — branch point

MIR	Annotation
<code>_63 = 2 &gt;&gt; 1</code>	Shift right operation
<code>→ switch(move _63) [1→bb53; else→bb54]</code>	Branch on move _63

### 1.5.54 bb53

MIR	Annotation
<code>_68 = 1 as RigidTy(Uint(U32))</code>	Integer conversion
<code>_69 = move _68 &lt; 32</code>	Less than operation
<code>→ assert(move _69 == true) → bb55</code>	Panic if move _69 is false

### 1.5.55 bb54 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _66 = panic([16 bytes])</code>	Call panic

### 1.5.56 bb55 — branch point

MIR	Annotation
<code>_67 = 3 &gt;&gt; 1</code>	Shift right operation
<code>→ switch(move _67) [1→bb56; else→bb57]</code>	Branch on move _67

### 1.5.57 bb56

MIR	Annotation
<code>_72 = 1 as RigidTy(Uint(U32))</code>	Integer conversion
<code>_73 = move _72 &lt; 32</code>	Less than operation
<code>→ assert(move _73 == true) → bb58</code>	Panic if move _73 is false

### 1.5.58 bb57 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _70 = panic([16 bytes])</code>	Call panic

### 1.5.59 bb58 — branch point

MIR	Annotation
<code>_71 = 1 &gt;&gt; 1</code>	Shift right operation
<code>→ switch(move _71) [0→bb59; else→bb60]</code>	Branch on move _71

### 1.5.60 bb59

MIR	Annotation
<code>_77 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _77.1 == false) → bb61</code>	Panic if move _77.1 is true

### 1.5.61 bb60 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _74 = panic([16 bytes])</code>	Call panic

### 1.5.62 bb61 — branch point

MIR	Annotation
<code>_76 = move _77.0</code>	Move value
<code>_75 = _1 &lt; move _76</code>	Less than operation
<code>→ switch(move _75) [0→bb63; else→bb62]</code>	Branch on move _75

### 1.5.63 bb62

MIR	Annotation
<code>_81 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _81.1 == false) → bb64</code>	Panic if move _81.1 is true

### 1.5.64 bb63 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _78 = panic([16 bytes])</code>	Call panic

### 1.5.65 bb64 — branch point

MIR	Annotation
<code>_80 = move _81.0</code>	Move value
<code>_79 = _1 &lt;= move _80</code>	Less or equal operation
<code>→ switch(move _79) [0→bb66; else→bb65]</code>	Branch on move _79

### 1.5.66 bb65

MIR	Annotation
<code>_86 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _86.1 == false) → bb67</code>	Panic if move _86.1 is true

### 1.5.67 bb66 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _82 = panic([16 bytes])</code>	Call panic

### 1.5.68 bb67

MIR	Annotation
<code>_85 = move _86.0</code>	Move value
<code>_87 = checked(_85 - _2)</code>	Checked Subtract (may panic)
<code>→ assert(move _87.1 == false) → bb68</code>	Panic if move _87.1 is true

### 1.5.69 bb68 — branch point

MIR	Annotation
<code>_84 = move _87.0</code>	Move value
<code>_83 = _1 &lt;= move _84</code>	Less or equal operation

<code>→ switch(move _83) [0→bb70; else→bb69]</code>	Branch on move _83
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### 1.5.70 bb69

MIR	Annotation
<code>_91 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _91.1 == false) → bb71</code>	Panic if move _91.1 is true

### 1.5.71 bb70 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _88 = panic([16 bytes])</code>	Call panic

### 1.5.72 bb71 — branch point

MIR	Annotation
<code>_90 = move _91.0</code>	Move value
<code>_89 = move _90 &gt; _1</code>	Greater than operation
<code>→ switch(move _89) [0→bb73; else→bb72]</code>	Branch on move _89

### 1.5.73 bb72

MIR	Annotation
<code>_95 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _95.1 == false) → bb74</code>	Panic if move _95.1 is true

### 1.5.74 bb73 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _92 = panic([16 bytes])</code>	Call panic

### 1.5.75 bb74 — branch point

MIR	Annotation
<code>_94 = move _95.0</code>	Move value
<code>_93 = move _94 &gt;= _1</code>	Greater or equal operation
<code>→ switch(move _93) [0→bb76; else→bb75]</code>	Branch on move _93

### 1.5.76 bb75

MIR	Annotation
<code>_100 = checked(_1 + _2)</code>	Checked Add (may panic)
<code>→ assert(move _100.1 == false) → bb77</code>	Panic if move _100.1 is true

### 1.5.77 bb76 — panic path

*Panic/diverging path.*

MIR	Annotation
<code>→ _96 = panic([16 bytes])</code>	Call panic

### 1.5.78 bb77

MIR	Annotation
_99 = move _100.0	Move value
_101 = checked(_99 - _2)	Checked Subtract (may panic)
→ assert(move _101.1 == false) → bb78	Panic if move _101.1 is true

### 1.5.79 bb78 — branch point

MIR	Annotation
_98 = move _101.0	Move value
_97 = move _98 >= _1	Greater or equal operation
→ switch(move _97) [0→bb80; else→bb79]	Branch on move _97

### 1.5.80 bb79 — return / success

*Normal return path.*

MIR	Annotation
→ return	Return from function

### 1.5.81 bb80 — panic path

*Panic/diverging path.*

MIR	Annotation
→ _102 = panic([16 bytes])	Call panic

## 1.6 Key Observations

TODO: Add bullet points summarizing what this MIR teaches

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## 1.7 Takeaways

TODO: One or two sentences to generalize this example

## 2 main — MIR Walkthrough

**Purpose:** TODO: Describe why this walkthrough exists

### 2.1 Source Context

```
test_binop(x, y);
return ();
}
```

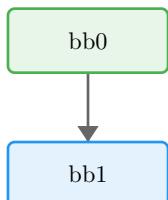
### 2.2 Function Overview

- **Function:** main
- **Basic blocks:** 2
- **Return type:** () (0 bytes, align 1)

### 2.3 Locals

Local	Type	Notes
0	() (0 bytes, align 1)	Return place
1	() (0 bytes, align 1)	
2	Int(I32)	
3	Int(I32)	

### 2.4 Control-Flow Overview



### 2.5 Basic Blocks

#### 2.5.1 bb0 — entry

*Entry point of the function.*

MIR	Annotation
_2 = 42	Load constant
_3 = 10	Load constant
→ _1 = test_binop(move _2, move _3) → bb1	Call test_binop

#### 2.5.2 bb1 — return / success

*Normal return path.*

MIR	Annotation
→ return	Return from function

### 2.6 Key Observations

TODO: Add bullet points summarizing what this MIR teaches

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## 2.7 Takeaways

TODO: One or two sentences to generalize this example

