

## PC/CP220 Project Phase II Checklist (3.01)

### A. General

1. Professionally presented  
Neat, etc. \_\_\_\_\_
2. Properly identified  
(eg. name, id) \_\_\_\_\_
3. On time  
at *beginning* of lab *with checklist* \_\_\_\_\_
4. Good grammar  
(eg. complete sentences where required) \_\_\_\_\_
5. Correct spelling  
\_\_\_\_\_

### B. Content

1. *All outputs analyzed*  
*(truth table)* \_\_\_\_\_
2. *Karnaugh maps (or equations)*  
*match truth table* \_\_\_\_\_
3. *Equations tested*  
*(Maple, Maxima, etc.)* \_\_\_\_\_
4. *Summary statement*  
*(all equations pass all tests)* \_\_\_\_\_
5. *Previous phase included*  
*(updated if necessary)* \_\_\_\_\_

CP220 PHASE II  
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Equations

Table

Digit	a3a2a1a0	Digit of Pi	b2b1b0
0	0000	3	0011
1	0001	1	0001
2	0010	4	0100
3	0011	1	0001
4	0100	5	0101
5	0101	9	1001
6	0110	2	0010
7	0111	6	0110
8	1000	5	0101
9	1001	3	0011

Master Table

a3	a2	a1	a0	b3	b2	b1	b0
0	0	0	0	0	0	1	1
0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	0	0	1	0	1
0	1	0	1	1	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	1	1	0
1	0	0	0	0	1	0	1
1	0	0	1	0	0	1	1

B0 Truth Table

a3	a2	a1	a0	b0
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1

### B0 Karnaugh Map

b0	a1a0				
a3a2		00	01	10	11
00	1	1	0	1	
01	1	1	0	0	
10	1	1	0	0	
11	0	0	0	0	

### B0 SOP

$$B0 = (a0')(a1')(a2')(a3') + (a0)(a1')(a2')(a3') + (a0)(a1)(a2')(a3') + (a0')(a1')(a2)(a3') + (a0)(a1')(a2)(a3) + (a0')(a1')(a2')(a3) + (a0)(a1')(a2')(a3) + (a0)(a1')(a2')(a3) + (a0')(a1)(a2')(a3)$$

### B0 Maxima

Code (with screen caps)

```
t1:(not a1) and (not a3);
t2: (not a0) and (not a2) and a3;
t3: (not a1) and (not a2);
t4: a0 and (not a2) and (not a3);
b0: t1 or t2 or t3 or t4;

b0, a0=false,a1=false,a2=false,a3=false;
b0, a0=false,a1=false,a2=false,a3=true;
b0, a0=false,a1=false,a2=true,a3=false;
b0, a0=false,a1=false,a2=true,a3=true;
b0, a0=false,a1=true,a2=false,a3=false;
b0, a0=false,a1=true,a2=false,a3=true;
b0, a0=false,a1=true,a2=true,a3=false;
b0, a0=false,a1=true,a2=true,a3=true;
b0, a0=true,a1=false,a2=false,a3=false;
b0, a0=true,a1=false,a2=false,a3=true;
b0, a0=true,a1=false,a2=true,a3=false;
b0, a0=true,a1=false,a2=true,a3=true;
b0, a0=true,a1=true,a2=false,a3=false;
b0, a0=true,a1=true,a2=false,a3=true;
b0, a0=true,a1=true,a2=true,a3=false;
```

b0, a0=true,a1=true,a2=true,a3=true;

```
bet365 - Online Sports Betting | Project Phase II instructions | Phase II checklist - CP-220 | CP220 PHASE II - Google Docs | (no subject) - connorlogan0 | CESGA - Maxima on line +  
Not Secure | maxima.cesga.es/index.php?c=twjzp5rav00koxtv/bkb55&n=20  
Apps VHL Central | Home New Tab CP213 TEXTBOOK CP212 TEXTBOOK  
(%i1) t1:(not a1) and (not a3);  
(%o1)  $\neg a_1 \wedge \neg a_3$   
  
(%i2) t2: (not a0) and (not a2) and a3;  
(%o2)  $\neg a_0 \wedge \neg a_2 \wedge a_3$   
  
(%i3) t3: (not a1) and (not a2);  
(%o3)  $\neg a_1 \wedge \neg a_2$   
  
(%i4) t4: a0 and (not a2) and (not a3);  
(%o4)  $a_0 \wedge \neg a_2 \wedge \neg a_3$   
  
(%i5) b0: t1 or t2 or t3 or t4;  
(%o5)  $\neg a_1 \wedge \neg a_3 \vee \neg a_0 \wedge \neg a_2 \wedge a_3 \vee \neg a_1 \wedge \neg a_2 \vee a_0 \wedge \neg a_2 \wedge \neg a_3$   
  
(%i6) b0, a0=false,a1=false,a2=false,a3=false;  
(%o6) true  
  
(%i7) b0, a0=false,a1=false,a2=false,a3=true;  
(%o7) true  
  
(%i8) b0, a0=false,a1=false,a2=true,a3=false;  
(%o8) true  
ph2_chk_301.co....pdf CP220 PHASE II.pdf Show All X
```

```
bet365 - Online Sports Betting | Project Phase II instructions | Phase II checklist - CP-220-PC | CP220 PHASE II - Google Docs | (no subject) - connorlogan0 | CESGA - Maxima on line +  
Not Secure | maxima.cesga.es/index.php?c=twjzp5rav00koxtv/bkb55&n=20  
Apps VHL Central | Home New Tab CP213 TEXTBOOK CP212 TEXTBOOK  
(%i9) b0, a0=false,a1=false,a2=true,a3=true;  
(%o9) false  
  
(%i10) b0, a0=false,a1=true,a2=false,a3=false;  
(%o10) false  
  
(%i11) b0, a0=false,a1=true,a2=false,a3=true;  
(%o11) true  
  
(%i12) b0, a0=false,a1=true,a2=true,a3=false;  
(%o12) false  
  
(%i13) b0, a0=false,a1=true,a2=true,a3=true;  
(%o13) false  
  
(%i14) b0, a0=true,a1=false,a2=false,a3=false;  
(%o14) true  
  
(%i15) b0, a0=true,a1=false,a2=false,a3=true;  
(%o15) true  
  
(%i16) b0, a0=true,a1=false,a2=true,a3=false;  
(%o16) true  
ph2_chk_301.co....pdf CP220 PHASE II.pdf Show All X
```

```

(%o14) true

(%i15) b0, a0=true,a1=false,a2=false,a3=true;
(%o15) true

(%i16) b0, a0=true,a1=false,a2=true,a3=false;
(%o16) true

(%i17) b0, a0=true,a1=false,a2=true,a3=true;
(%o17) false

(%i18) b0, a0=true,a1=true,a2=false,a3=false;
(%o18) true

(%i19) b0, a0=true,a1=true,a2=false,a3=true;
(%o19) false

(%i20) b0, a0=true,a1=true,a2=true,a3=false;
(%o20) false

(%i21) b0, a0=true,a1=true,a2=true,a3=true;
(%o21) false

```

Yamwi

ph2\_chk\_301.co....pdf CP220 PHASE II.pdf Show All X

### B1 Truth Table

a3	a2	a1	a0	b1
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1

### B1 Karnaugh Map

b1	a1a0				
a3a2		00	01	10	11
00	1	0	0	0	0
01	0	0	1	1	1
10	0	1	0	0	0
11	0	0	0	0	0

### B1 SOP

$$B1 = (a3')(a2)(a1')(a0') + (a3)(a2')(a1')(a0) + (a3')(a2)$$

### B1 Maxima

Code (with screen caps)

t1:(not a3) and (a2) and (not a1) and (not a0);

t2: (a3)and (not a2) and (not a1) and (a0);

t3: (not a3) and (a2);

b1: t1 or t2 or t3;

b1, a0=false,a1=false,a2=false,a3=false;

```
b1, a0=false,a1=false,a2=false,a3=true;
b1, a0=false,a1=false,a2=true,a3=false;
b1, a0=false,a1=false,a2=true,a3=true;
b1, a0=false,a1=true,a2=false,a3=false;
b1, a0=false,a1=true,a2=false,a3=true;
b1, a0=false,a1=true,a2=true,a3=false;
b1, a0=false,a1=true,a2=true,a3=true;
b1, a0=true,a1=false,a2=false,a3=false;
b1, a0=true,a1=false,a2=false,a3=true;
b1, a0=true,a1=false,a2=true,a3=false;
b1, a0=true,a1=false,a2=true,a3=true;
b1, a0=true,a1=true,a2=false,a3=false;
b1, a0=true,a1=true,a2=false,a3=true;
b1, a0=true,a1=true,a2=true,a3=false;
b1, a0=true,a1=true,a2=true,a3=true;
```

The screenshot shows a web browser window with multiple tabs open. The visible tabs include:

- bet365 - Online Sports Betting
- Project Phase II instructions
- Phase II checklist - CP-220-PC
- CP220 PHASE II - Google Docs
- CESGA - Maxima on line

The main content area displays a series of logic problems (t1 through t18) and their corresponding solutions (%o1 through %o8). The logic problems involve variables a0, a1, a2, and a3.

```
(%i1) t1:(not a3) and (a2) and (not a1) and (not a0);
(%o1)  ~a3 ∧ a2 ∧ ~a1 ∧ ~a0

(%i2) t2: (a3) and (not a2) and (not a1) and (a0);
(%o2)  a3 ∧ ~a2 ∧ ~a1 ∧ a0

(%i3) t3: (not a3) and (a2);
(%o3)  ~a3 ∧ a2

(%i4) b1: t1 or t2 or t3;
(%o4)  ~a3 ∧ a2 ∧ ~a1 ∧ ~a0 ∨ a3 ∧ ~a2 ∧ ~a1 ∧ a0 ∨ ~a3 ∧ a2

(%i5) b1, a0=false,a1=false,a2=false,a3=false;
(%o5)  false

(%i6) b1, a0=false,a1=false,a2=false,a3=true;
(%o6)  false

(%i7) b1, a0=false,a1=false,a2=true,a3=false;
(%o7)  true

(%i8) b1, a0=false,a1=false,a2=true,a3=true;
(%o8)  false
```

At the bottom of the browser window, there are two file icons: "ph2\_chk\_301.co....pdf" and "CP220 PHASE II.pdf". On the right side of the browser window, there are buttons for "Show All" and a close button.

The screenshot shows a web browser window with multiple tabs open. The active tab displays a Maxima session. The session output is as follows:

```
(%i9) b1, a0=false,a1=true,a2=false,a3=false;
(%o9) false

(%i10) b1, a0=false,a1=true,a2=false,a3=true;
(%o10) false

(%i11) b1, a0=false,a1=true,a2=true,a3=false;
(%o11) true

(%i12) b1, a0=false,a1=true,a2=true,a3=true;
(%o12) false

(%i13) b1, a0=true,a1=false,a2=false,a3=false;
(%o13) false

(%i14) b1, a0=true,a1=false,a2=false,a3=true;
(%o14) true

(%i15) b1, a0=true,a1=false,a2=true,a3=false;
(%o15) true

(%i16) b1, a0=true,a1=false,a2=true,a3=true;
(%o16) false
```

Below the Maxima session, there is a PDF viewer interface showing two files: "ph2\_chk\_301\_co....pdf" and "CP220 PHASE II.pdf".

```

(%o13) false

(%i14) b1, a0=true,a1=false,a2=false,a3=true;
(%o14) true

(%i15) b1, a0=true,a1=false,a2=true,a3=false;
(%o15) true

(%i16) b1, a0=true,a1=false,a2=true,a3=true;
(%o16) false

(%i17) b1, a0=true,a1=true,a2=false,a3=false;
(%o17) false

(%i18) b1, a0=true,a1=true,a2=false,a3=true;
(%o18) false

(%i19) b1, a0=true,a1=true,a2=true,a3=false;
(%o19) true

(%i20) b1, a0=true,a1=true,a2=true,a3=true;
(%o20) false

```

Yamwi

ph2\_chk\_301.co....pdf ^ CP220 PHASE II.pdf ^ Show All X

### B2 Truth Table

a3	a2	a1	a0	b2
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0

0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0

### B2 Karnaugh Map

b2	a1a0				
a3a2		00	01	10	11
00	00	0	0	1	0
	01	1	0	0	1
	10	1	0	0	0
	11	0	0	0	0

### B2 SOP

$$B2 = (a3')(a2')(a1)(a0') + (a1')(a0') + (a3')(a2)(a1)(a0)$$

### B2 Maxima

Code (with screencaps)

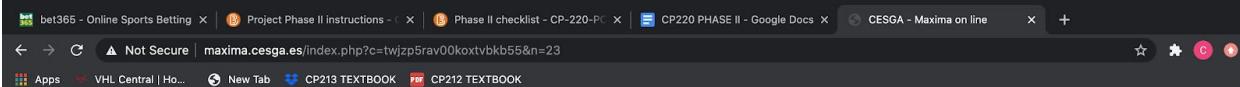
```
t1:(not a3) and (not a2) and (a1) and (a0);
```

t2: (not a1) and (not a0);

t3: (not a3) and (a2) and (a1) and (a0);

b2: t1 or t2 or t3;

b2, a0=false,a1=false,a2=false,a3=false;  
b2, a0=false,a1=false,a2=false,a3=true;  
b2, a0=false,a1=false,a2=true,a3=false;  
b2, a0=false,a1=false,a2=true,a3=true;  
b2, a0=false,a1=true,a2=false,a3=false;  
b2, a0=false,a1=true,a2=false,a3=true;  
b2, a0=false,a1=true,a2=true,a3=false;  
b2, a0=false,a1=true,a2=true,a3=true;  
b2, a0=true,a1=false,a2=false,a3=false;  
b2, a0=true,a1=false,a2=false,a3=true;  
b2, a0=true,a1=false,a2=true,a3=false;  
b2, a0=true,a1=false,a2=true,a3=true;  
b2, a0=true,a1=true,a2=false,a3=false;  
b2, a0=true,a1=true,a2=false,a3=true;  
b2, a0=true,a1=true,a2=true,a3=false;  
b2, a0=true,a1=true,a2=true,a3=true;



```
(%i1) t1:(not a3) and (not a2) and (a1) and (a0);
(%o1)  ~a3 ∧ ~a2 ∧ a1 ∧ a0

(%i2) t2: (not a1) and (not a0);
(%o2)  ~a1 ∧ ~a0

(%i3) t3: (not a3) and (a2) and (a1) and (a0);
(%o3)  ~a3 ∧ a2 ∧ a1 ∧ a0

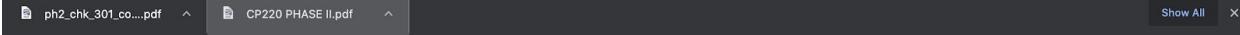
(%i4) b2: t1 or t2 or t3;
(%o4)  ~a3 ∧ ~a2 ∧ a1 ∧ a0 ∨ ~a1 ∧ ~a0 ∨ ~a3 ∧ a2 ∧ a1 ∧ a0

(%i5) b2, a0=false,a1=false,a2=false,a3=false;
(%o5)  true

(%i6) b2, a0=false,a1=false,a2=false,a3=true;
(%o6)  ~a1

(%i7) b2, a0=false,a1=false,a2=true,a3=false;
(%o7)  true

(%i8) b2, a0=false,a1=false,a2=true,a3=true;
```



```

bet365 - Online Sports Betting | Project Phase II instructions - | Phase II checklist - CP-220-PC | CP220 PHASE II - Google Docs | CESGA - Maxima on line
← → ⚡ Not Secure | maxima.cesga.es/index.php?c=twjzp5av00koxtvbkb55&n=23
Apps VHL Central | Ho... New Tab CP213 TEXTBOOK CP212 TEXTBOOK
(%i8) b2, a0=false,a1=false,a2=true,a3=true;
(%o8) true

(%i9) b2, a0=false,a1=true,a2=false,a3=false;
(%o9) false

(%i10) b2, a0=false,a1=true,a2=false,a3=true;
(%o10) false

(%i11) b2, a0=false,a1=true,a2=true,a3=false;
(%o11) false

(%i12) b2, a0=false,a1=true,a2=true,a3=true;
(%o12) false

(%i13) b2, a0=true,a1=false,a2=false,a3=false;
(%o13) false

(%i14) b2, a0=true,a1=false,a2=false,a3=true;
(%o14) false

(%i15) b2, a0=true,a1=false,a2=true,a3=false;
(%o15) false

(%i16) b2, a0=true,a1=false,a2=true,a3=true;
(%o16) false

(%i17) b2, a0=true,a1=true,a2=false,a3=false;
(%o17) true

(%i18) b2, a0=true,a1=true,a2=false,a3=true;
(%o18) false

(%i19) b2, a0=true,a1=true,a2=true,a3=false;
(%o19) true

(%i20) b2, a0=true,a1=true,a2=true,a3=true;
(%o20) false

```

Yamwi

### B3 Truth Table

a3	a2	a1	a0	b3
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0

B3 Karnaugh Map

b3	a1a0				
a3a2		00	01	10	11
	00	0	0	0	0
	01	0	1	0	0
	10	0	0	0	0
	11	0	0	0	0

### B3 SOP

$$B3 = (a3')(a2)(a1')(a0)$$

### B3 Maxima

Code (with screencaps)

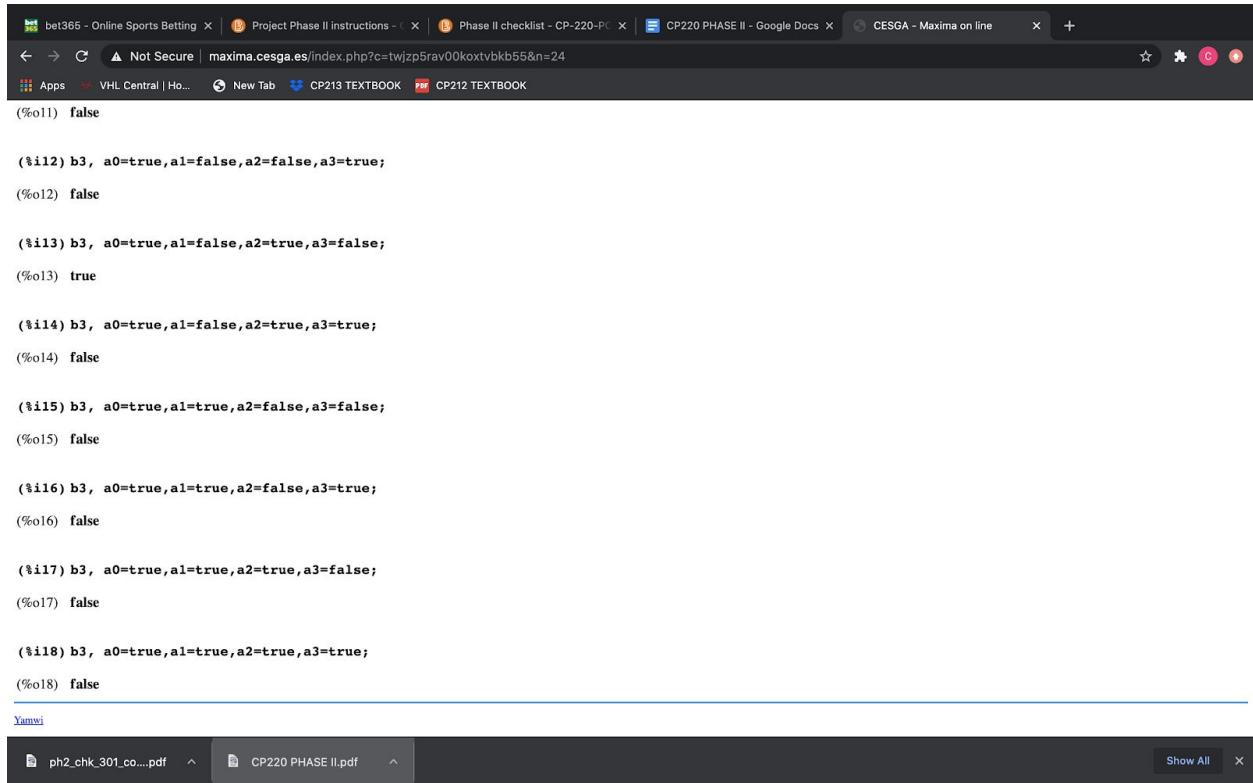
```
t1:(not a3) and (a2) and (not a1) and (a0);
```

```
b3: t1;
```

```
b3, a0=false,a1=false,a2=false,a3=false;
b3, a0=false,a1=false,a2=false,a3=true;
b3, a0=false,a1=false,a2=true,a3=false;
b3, a0=false,a1=false,a2=true,a3=true;
b3, a0=false,a1=true,a2=false,a3=false;
b3, a0=false,a1=true,a2=false,a3=true;
b3, a0=false,a1=true,a2=true,a3=false;
b3, a0=false,a1=true,a2=true,a3=true;
b3, a0=true,a1=false,a2=false,a3=false;
b3, a0=true,a1=false,a2=false,a3=true;
b3, a0=true,a1=false,a2=true,a3=false;
b3, a0=true,a1=false,a2=true,a3=true;
b3, a0=true,a1=true,a2=false,a3=false;
b3, a0=true,a1=true,a2=false,a3=true;
b3, a0=true,a1=true,a2=true,a3=false;
b3, a0=true,a1=true,a2=true,a3=true;
```

```
(%i1) t1:(not a3) and (a2) and (not a1) and (a0);  
(%o1) ~a3 ∧ a2 ∧ ~a1 ∧ a0  
  
(%i2) b3: t1;  
(%o2) ~a3 ∧ a2 ∧ ~a1 ∧ a0  
  
(%i3) b3, a0=false,a1=false,a2=false,a3=false;  
(%o3) false  
  
(%i4) b3, a0=false,a1=false,a2=false,a3=true;  
(%o4) false  
  
(%i5) b3, a0=false,a1=false,a2=true,a3=false;  
(%o5) false  
  
(%i6) b3, a0=false,a1=false,a2=true,a3=true;  
(%o6) false  
  
(%i7) b3, a0=false,a1=true,a2=false,a3=false;  
(%o7) false  
  
(%i8) b3, a0=false,a1=true,a2=false,a3=true;  
(%o8) false  
  
(%i9) b3, a0=false,a1=true,a2=true,a3=false;  
(%o9) false  
  
(%i10) b3, a0=false,a1=true,a2=true,a3=true;  
(%o10) false  
  
(%i11) b3, a0=true,a1=false,a2=false,a3=false;  
(%o11) false  
  
(%i12) b3, a0=true,a1=false,a2=false,a3=true;  
(%o12) false  
  
(%i13) b3, a0=true,a1=false,a2=true,a3=false;  
(%o13) true  
  
(%i14) b3, a0=true,a1=false,a2=true,a3=true;  
(%o14) false  
  
(%i15) b3, a0=true,a1=true,a2=false,a3=false;  
(%o15) false
```

```
(%i16) b3, a0=false,a1=false,a2=true,a3=false;  
(%o16) false  
  
(%i17) b3, a0=false,a1=false,a2=true,a3=true;  
(%o17) false  
  
(%i18) b3, a0=false,a1=true,a2=false,a3=true;  
(%o18) false  
  
(%i19) b3, a0=false,a1=true,a2=true,a3=false;  
(%o19) false  
  
(%i20) b3, a0=false,a1=true,a2=true,a3=true;  
(%o20) false  
  
(%i21) b3, a0=true,a1=false,a2=false,a3=false;  
(%o21) false  
  
(%i22) b3, a0=true,a1=false,a2=false,a3=true;  
(%o22) false  
  
(%i23) b3, a0=true,a1=false,a2=true,a3=false;  
(%o23) true  
  
(%i24) b3, a0=true,a1=false,a2=true,a3=true;  
(%o24) false  
  
(%i25) b3, a0=true,a1=true,a2=false,a3=false;  
(%o25) false
```



The screenshot shows a web browser window with several tabs open. The tabs include:

- bet365 - Online Sports Betting
- Project Phase II instructions -
- Phase II checklist - CP-220-PC
- CP220 PHASE II - Google Docs
- CESGA - Maxima on line

The main content area displays a Maxima session output:

```
(%o11) false

(%i12) b3, a0=true,a1=false,a2=false,a3=true;
(%o12) false

(%i13) b3, a0=true,a1=false,a2=true,a3=false;
(%o13) true

(%i14) b3, a0=true,a1=false,a2=true,a3=true;
(%o14) false

(%i15) b3, a0=true,a1=true,a2=false,a3=false;
(%o15) false

(%i16) b3, a0=true,a1=true,a2=false,a3=true;
(%o16) false

(%i17) b3, a0=true,a1=true,a2=true,a3=false;
(%o17) false

(%i18) b3, a0=true,a1=true,a2=true,a3=true;
(%o18) false
```

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Yamwi

ph2\_chk\_301.co....pdf ^ CP220 PHASE II.pdf ^ Show All X

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Fall Semester of 2020

### Description

In mathematics, there are a number of significant concepts. One of which is Pi. The Greek letter  $\pi$  is used to represent the ratio of a circle to its diameter. As well, Pi is used very heavily within trigonometry. This mathematical constant also has no end, it is an irrational number. The Digits of Pi Sequence Circuit will output the binary representation of the first 10 digits of Pi to the user using this circuit.

### Inputs

The Digits of Pi Sequence Circuit will have 4 inputs. Ranging from  $a_0$  to  $a_3$ . There will be 10 sequences of inputs all representing the binary value of each decimal place.

### Outputs

The Digits of Pi Sequence Circuit will have 4 outputs. Ranging from  $b_0$  to  $b_3$ . These outputs will be the binary representation of the digit of Pi that corresponds to the input decimal place.

### Notes

This circuit will only be allowed to display the first 10 digits of Pi. Any inputs from 11-15 that are possible will result in errors. For these inputs, all lights will turn on to indicate there is an error. This is due to the fact that all LED lights on would be more noticeable in case there is an error. There are also no ambiguities related to this project.

### Table

Input	Output
0000	0011
0001	0001
0010	0100
0011	0001
0100	0101
0101	1001
0110	0010
0111	0110
1000	0101

10001	0011
-------	------