**Minimal Constraint Subsets Detected for differential trail in Table 7 DDH21+ and PT22**

the 0 th Minimal Constraint set is:

y^0\_0 + [y^0\_10] + [y^0\_13] + [x^1\_0] + k\_0= 0

y^0\_0 + [y^0\_10] + x^1\_12 + k\_0= 0

[y^0\_7] + [y^0\_10] + x^1\_8 + k\_7= 0

y^1\_2 + x^2\_6 + k\_8= 0

y^1\_2 + y^1\_8 + x^2\_14 + k\_8= 0

y^1\_3 + y^1\_9 + y^1\_12 + x^2\_3 + k\_13= 0

y^1\_3 + y^1\_9 + x^2\_15 + k\_13= 0

y^2\_1 + y^2\_11 + y^2\_14 + x^3\_1 + k\_7= 0

y^2\_1 + y^2\_11 + x^3\_13 + k\_7= 0

y^2\_2 + y^2\_8 + y^2\_15 + [x^3\_2] + k\_0= 0

y^2\_2 + y^2\_8 + [x^3\_14] + k\_0= 0

y^2\_3 + y^2\_9 + x^3\_15 + k\_5= 0

y^2\_6 + y^2\_9 + x^3\_11 + k\_4= 0

y^3\_0 + y^3\_10 + y^3\_13 + x^4\_0 + k\_15= 0

y^3\_0 + y^3\_10 + x^4\_12 + k\_15= 0

y^3\_1 + y^3\_11 + [y^3\_14] + [x^4\_1] + k\_11= 0

[y^3\_2] + y^3\_8 + y^3\_15 + x^4\_2 + k\_9= 0

[y^3\_2] + y^3\_8 + x^4\_14 + k\_9= 0

y^3\_3 + x^4\_7 + k\_14= 0

y^3\_3 + y^3\_9 + x^4\_15 + k\_14= 0

[y^3\_6] + y^3\_9 + [x^4\_11] + k\_10= 0

y^4\_0 + y^4\_10 + x^5\_12 + k\_7= 0

[y^4\_1] + [y^4\_11] + y^4\_14 + x^5\_1 + k\_3= 0

[y^4\_1] + [y^4\_11] + x^5\_13 + k\_3= 0

y^4\_2 + y^4\_8 + y^4\_15 + x^5\_2 + k\_1= 0

y^4\_2 + x^5\_6 + k\_1= 0

y^4\_2 + y^4\_8 + x^5\_14 + k\_1= 0

y^4\_3 + y^4\_9 + y^4\_12 + x^5\_3 + k\_6= 0

y^4\_3 + y^4\_9 + x^5\_15 + k\_6= 0

y^4\_7 + y^4\_10 + x^5\_8 + k\_5= 0

y^5\_0 + y^5\_10 + y^5\_13 + x^6\_0 + k\_11= 0

y^5\_0 + y^5\_10 + x^6\_12 + k\_11= 0

y^5\_1 + y^5\_11 + y^5\_14 + x^6\_1 + k\_13= 0

y^5\_1 + x^6\_5 + k\_13= 0

y^5\_1 + y^5\_11 + x^6\_13 + k\_13= 0

y^5\_2 + y^5\_8 + y^5\_15 + x^6\_2 + k\_15= 0

y^5\_2 + x^6\_6 + k\_15= 0

y^5\_2 + y^5\_8 + x^6\_14 + k\_15= 0

y^5\_3 + y^5\_9 + y^5\_12 + x^6\_3 + k\_12= 0

[y^5\_5] + y^5\_8 + x^6\_10 + k\_10= 0

y^5\_6 + y^5\_9 + x^6\_11 + k\_8= 0

y^6\_0 + y^6\_10 + y^6\_13 + x^7\_0 + k\_3= 0

y^6\_1 + y^6\_11 + y^6\_14 + x^7\_1 + k\_5= 0

y^6\_2 + y^6\_8 + x^7\_14 + k\_7= 0

y^6\_3 + [y^6\_9] + y^6\_12 + [x^7\_3] + k\_4= 0

y^6\_3 + x^7\_7 + k\_4= 0

y^6\_3 + [y^6\_9] + [x^7\_15] + k\_4= 0

y^6\_5 + y^6\_8 + x^7\_10 + k\_2= 0

y^6\_6 + [y^6\_9] + x^7\_11 + k\_0= 0

y^7\_0 + x^8\_4 + k\_13= 0

y^7\_1 + y^7\_11 + y^7\_14 + x^8\_1 + k\_14= 0

y^7\_7 + y^7\_10 + x^8\_8 + k\_12= 0

y^8\_1 + [y^8\_11] + [x^9\_13] + k\_6= 0

[y^8\_2] + y^8\_8 + [x^9\_14] + k\_3= 0

y^8\_4 + [y^8\_11] + [x^9\_9] + k\_7= 0

S(x^1\_8) + y^1\_8= 0

S(x^1\_12) + y^1\_12= 0

S(x^2\_3) + y^2\_3= 0

S(x^2\_6) + y^2\_6= 0

S(x^2\_14) + y^2\_14= 0

S(x^2\_15) + y^2\_15= 0

S(x^3\_1) + y^3\_1= 0

S(x^3\_11) + y^3\_11= 0

S(x^3\_13) + y^3\_13= 0

S(x^3\_15) + y^3\_15= 0

S(x^4\_0) + y^4\_0= 0

S(x^4\_2) + y^4\_2= 0

S(x^4\_7) + y^4\_7= 0

S(x^4\_12) + y^4\_12= 0

S(x^4\_14) + y^4\_14= 0

S(x^4\_15) + y^4\_15= 0

S(x^5\_1) + y^5\_1= 0

S(x^5\_2) + y^5\_2= 0

S(x^5\_3) + y^5\_3= 0

S(x^5\_6) + y^5\_6= 0

S(x^5\_8) + y^5\_8= 0

S(x^5\_12) + y^5\_12= 0

S(x^5\_13) + y^5\_13= 0

S(x^5\_14) + y^5\_14= 0

S(x^5\_15) + y^5\_15= 0

S(x^6\_0) + y^6\_0= 0

S(x^6\_1) + y^6\_1= 0

S(x^6\_2) + y^6\_2= 0

S(x^6\_3) + y^6\_3= 0

S(x^6\_5) + y^6\_5= 0

S(x^6\_6) + y^6\_6= 0

S(x^6\_10) + y^6\_10= 0

S(x^6\_11) + y^6\_11= 0

S(x^6\_12) + y^6\_12= 0

S(x^6\_13) + y^6\_13= 0

S(x^6\_14) + y^6\_14= 0

S(x^7\_0) + y^7\_0= 0

S(x^7\_1) + y^7\_1= 0

S(x^7\_7) + y^7\_7= 0

S(x^7\_10) + y^7\_10= 0

S(x^7\_11) + y^7\_11= 0

S(x^7\_14) + y^7\_14= 0

S(x^8\_1) + y^8\_1= 0

S(x^8\_4) + y^8\_4= 0

S(x^8\_8) + y^8\_8= 0

the 1 th Minimal Constraint set is:

y^0\_0 + [y^0\_10] + [y^0\_13] + [x^1\_0] + k\_0= 0

y^0\_0 + [y^0\_10] + x^1\_12 + k\_0= 0

y^1\_3 + y^1\_9 + y^1\_12 + x^2\_3 + k\_13= 0

y^1\_3 + y^1\_9 + x^2\_15 + k\_13= 0

y^2\_2 + y^2\_8 + y^2\_15 + [x^3\_2] + k\_0= 0

y^2\_2 + y^2\_8 + [x^3\_14] + k\_0= 0

y^2\_3 + x^3\_7 + k\_5= 0

y^3\_0 + x^4\_4 + k\_15= 0

y^3\_0 + y^3\_10 + x^4\_12 + k\_15= 0

y^3\_1 + y^3\_11 + [y^3\_14] + [x^4\_1] + k\_11= 0

y^3\_1 + y^3\_11 + x^4\_13 + k\_11= 0

[y^3\_2] + x^4\_6 + k\_9= 0

y^3\_7 + y^3\_10 + x^4\_8 + k\_13= 0

y^4\_0 + y^4\_10 + y^4\_13 + x^5\_0 + k\_7= 0

y^4\_0 + y^4\_10 + x^5\_12 + k\_7= 0

y^4\_2 + x^5\_6 + k\_1= 0

y^4\_2 + y^4\_8 + x^5\_14 + k\_1= 0

y^4\_3 + y^4\_9 + y^4\_12 + x^5\_3 + k\_6= 0

y^4\_3 + x^5\_7 + k\_6= 0

y^4\_4 + [y^4\_11] + x^5\_9 + k\_0= 0

y^4\_6 + y^4\_9 + x^5\_11 + k\_2= 0

y^5\_0 + y^5\_10 + x^6\_12 + k\_11= 0

y^5\_1 + y^5\_11 + y^5\_14 + x^6\_1 + k\_13= 0

y^5\_1 + x^6\_5 + k\_13= 0

y^5\_2 + x^6\_6 + k\_15= 0

y^5\_2 + y^5\_8 + x^6\_14 + k\_15= 0

y^5\_3 + y^5\_9 + y^5\_12 + x^6\_3 + k\_12= 0

y^5\_3 + x^6\_7 + k\_12= 0

y^5\_3 + y^5\_9 + x^6\_15 + k\_12= 0

[y^5\_5] + y^5\_8 + x^6\_10 + k\_10= 0

y^5\_6 + y^5\_9 + x^6\_11 + k\_8= 0

y^5\_7 + y^5\_10 + x^6\_8 + k\_14= 0

y^6\_1 + y^6\_11 + y^6\_14 + x^7\_1 + k\_5= 0

y^6\_2 + y^6\_8 + y^6\_15 + x^7\_2 + k\_7= 0

y^6\_2 + y^6\_8 + x^7\_14 + k\_7= 0

y^6\_3 + [y^6\_9] + y^6\_12 + [x^7\_3] + k\_4= 0

y^6\_3 + x^7\_7 + k\_4= 0

y^6\_3 + [y^6\_9] + [x^7\_15] + k\_4= 0

y^6\_5 + y^6\_8 + x^7\_10 + k\_2= 0

y^6\_6 + [y^6\_9] + x^7\_11 + k\_0= 0

y^6\_7 + y^6\_10 + x^7\_8 + k\_6= 0

y^7\_1 + y^7\_11 + y^7\_14 + x^8\_1 + k\_14= 0

y^7\_2 + y^7\_8 + x^8\_14 + k\_11= 0

y^7\_7 + y^7\_10 + x^8\_8 + k\_12= 0

y^8\_1 + [y^8\_11] + y^8\_14 + [x^9\_1] + k\_6= 0

[y^8\_2] + y^8\_8 + [x^9\_14] + k\_3= 0

S(x^1\_12) + y^1\_12= 0

S(x^2\_3) + y^2\_3= 0

S(x^2\_15) + y^2\_15= 0

S(x^3\_7) + y^3\_7= 0

S(x^4\_4) + y^4\_4= 0

S(x^4\_6) + y^4\_6= 0

S(x^4\_8) + y^4\_8= 0

S(x^4\_12) + y^4\_12= 0

S(x^4\_13) + y^4\_13= 0

S(x^5\_0) + y^5\_0= 0

S(x^5\_3) + y^5\_3= 0

S(x^5\_6) + y^5\_6= 0

S(x^5\_7) + y^5\_7= 0

S(x^5\_9) + y^5\_9= 0

S(x^5\_11) + y^5\_11= 0

S(x^5\_12) + y^5\_12= 0

S(x^5\_14) + y^5\_14= 0

S(x^6\_1) + y^6\_1= 0

S(x^6\_3) + y^6\_3= 0

S(x^6\_5) + y^6\_5= 0

S(x^6\_6) + y^6\_6= 0

S(x^6\_7) + y^6\_7= 0

S(x^6\_8) + y^6\_8= 0

S(x^6\_10) + y^6\_10= 0

S(x^6\_11) + y^6\_11= 0

S(x^6\_12) + y^6\_12= 0

S(x^6\_14) + y^6\_14= 0

S(x^6\_15) + y^6\_15= 0

S(x^7\_1) + y^7\_1= 0

S(x^7\_2) + y^7\_2= 0

S(x^7\_7) + y^7\_7= 0

S(x^7\_8) + y^7\_8= 0

S(x^7\_10) + y^7\_10= 0

S(x^7\_11) + y^7\_11= 0

S(x^7\_14) + y^7\_14= 0

S(x^8\_1) + y^8\_1= 0

S(x^8\_8) + y^8\_8= 0

S(x^8\_14) + y^8\_14= 0

the 2 th Minimal Constraint set is:

y^0\_0 + [y^0\_10] + [y^0\_13] + [x^1\_0] + k\_0= 0

y^0\_0 + [y^0\_10] + x^1\_12 + k\_0= 0

[y^1\_0] + x^2\_4 + k\_9= 0

y^1\_3 + y^1\_9 + y^1\_12 + x^2\_3 + k\_13= 0

y^1\_3 + y^1\_9 + x^2\_15 + k\_13= 0

y^2\_1 + x^3\_5 + k\_7= 0

y^2\_1 + y^2\_11 + x^3\_13 + k\_7= 0

y^2\_2 + y^2\_8 + y^2\_15 + [x^3\_2] + k\_0= 0

y^2\_2 + y^2\_8 + [x^3\_14] + k\_0= 0

y^2\_3 + x^3\_7 + k\_5= 0

y^2\_4 + y^2\_11 + x^3\_9 + k\_2= 0

y^3\_0 + y^3\_10 + y^3\_13 + x^4\_0 + k\_15= 0

y^3\_0 + x^4\_4 + k\_15= 0

[y^3\_2] + x^4\_6 + k\_9= 0

[y^3\_2] + y^3\_8 + x^4\_14 + k\_9= 0

y^3\_3 + x^4\_7 + k\_14= 0

y^3\_3 + y^3\_9 + x^4\_15 + k\_14= 0

y^3\_5 + y^3\_8 + x^4\_10 + k\_12= 0

y^3\_7 + y^3\_10 + x^4\_8 + k\_13= 0

y^4\_0 + x^5\_4 + k\_7= 0

[y^4\_1] + [y^4\_11] + y^4\_14 + x^5\_1 + k\_3= 0

y^4\_2 + y^4\_8 + y^4\_15 + x^5\_2 + k\_1= 0

y^4\_2 + x^5\_6 + k\_1= 0

y^4\_3 + x^5\_7 + k\_6= 0

y^4\_3 + y^4\_9 + x^5\_15 + k\_6= 0

y^4\_4 + [y^4\_11] + x^5\_9 + k\_0= 0

y^4\_6 + y^4\_9 + x^5\_11 + k\_2= 0

y^4\_7 + y^4\_10 + x^5\_8 + k\_5= 0

y^5\_0 + x^6\_4 + k\_11= 0

y^5\_0 + y^5\_10 + x^6\_12 + k\_11= 0

y^5\_1 + x^6\_5 + k\_13= 0

y^5\_2 + y^5\_8 + y^5\_15 + x^6\_2 + k\_15= 0

y^5\_4 + y^5\_11 + [x^6\_9] + k\_9= 0

y^5\_6 + y^5\_9 + x^6\_11 + k\_8= 0

y^5\_7 + y^5\_10 + x^6\_8 + k\_14= 0

y^6\_2 + x^7\_6 + k\_7= 0

y^6\_3 + [y^6\_9] + y^6\_12 + [x^7\_3] + k\_4= 0

y^6\_3 + x^7\_7 + k\_4= 0

y^6\_4 + y^6\_11 + x^7\_9 + k\_1= 0

y^6\_5 + y^6\_8 + x^7\_10 + k\_2= 0

y^7\_6 + y^7\_9 + [x^8\_11] + k\_9= 0

y^7\_7 + y^7\_10 + x^8\_8 + k\_12= 0

[y^8\_2] + y^8\_8 + [x^9\_14] + k\_3= 0

S(x^1\_12) + y^1\_12= 0

S(x^2\_3) + y^2\_3= 0

S(x^2\_4) + y^2\_4= 0

S(x^2\_15) + y^2\_15= 0

S(x^3\_5) + y^3\_5= 0

S(x^3\_7) + y^3\_7= 0

S(x^3\_9) + y^3\_9= 0

S(x^3\_13) + y^3\_13= 0

S(x^4\_0) + y^4\_0= 0

S(x^4\_4) + y^4\_4= 0

S(x^4\_6) + y^4\_6= 0

S(x^4\_7) + y^4\_7= 0

S(x^4\_8) + y^4\_8= 0

S(x^4\_10) + y^4\_10= 0

S(x^4\_14) + y^4\_14= 0

S(x^4\_15) + y^4\_15= 0

S(x^5\_1) + y^5\_1= 0

S(x^5\_2) + y^5\_2= 0

S(x^5\_4) + y^5\_4= 0

S(x^5\_6) + y^5\_6= 0

S(x^5\_7) + y^5\_7= 0

S(x^5\_8) + y^5\_8= 0

S(x^5\_9) + y^5\_9= 0

S(x^5\_11) + y^5\_11= 0

S(x^5\_15) + y^5\_15= 0

S(x^6\_2) + y^6\_2= 0

S(x^6\_4) + y^6\_4= 0

S(x^6\_5) + y^6\_5= 0

S(x^6\_8) + y^6\_8= 0

S(x^6\_11) + y^6\_11= 0

S(x^6\_12) + y^6\_12= 0

S(x^7\_6) + y^7\_6= 0

S(x^7\_7) + y^7\_7= 0

S(x^7\_9) + y^7\_9= 0

S(x^7\_10) + y^7\_10= 0

S(x^8\_8) + y^8\_8= 0

the 3 th Minimal Constraint set is:

[y^0\_7] + [y^0\_10] + x^1\_8 + k\_7= 0

y^1\_2 + x^2\_6 + k\_8= 0

y^1\_2 + y^1\_8 + x^2\_14 + k\_8= 0

y^2\_1 + y^2\_11 + y^2\_14 + x^3\_1 + k\_7= 0

y^2\_1 + y^2\_11 + x^3\_13 + k\_7= 0

y^2\_3 + x^3\_7 + k\_5= 0

y^2\_3 + y^2\_9 + x^3\_15 + k\_5= 0

y^2\_6 + y^2\_9 + x^3\_11 + k\_4= 0

y^3\_0 + y^3\_10 + y^3\_13 + x^4\_0 + k\_15= 0

y^3\_0 + x^4\_4 + k\_15= 0

y^3\_1 + y^3\_11 + x^4\_13 + k\_11= 0

[y^3\_2] + y^3\_8 + y^3\_15 + x^4\_2 + k\_9= 0

[y^3\_2] + x^4\_6 + k\_9= 0

[y^3\_2] + y^3\_8 + x^4\_14 + k\_9= 0

y^3\_3 + x^4\_7 + k\_14= 0

y^3\_3 + y^3\_9 + x^4\_15 + k\_14= 0

[y^3\_6] + y^3\_9 + [x^4\_11] + k\_10= 0

y^3\_7 + y^3\_10 + x^4\_8 + k\_13= 0

y^4\_0 + y^4\_10 + y^4\_13 + x^5\_0 + k\_7= 0

[y^4\_1] + [y^4\_11] + y^4\_14 + x^5\_1 + k\_3= 0

[y^4\_1] + [y^4\_11] + x^5\_13 + k\_3= 0

y^4\_2 + y^4\_8 + y^4\_15 + x^5\_2 + k\_1= 0

y^4\_3 + x^5\_7 + k\_6= 0

y^4\_3 + y^4\_9 + x^5\_15 + k\_6= 0

y^4\_4 + [y^4\_11] + x^5\_9 + k\_0= 0

y^4\_6 + y^4\_9 + x^5\_11 + k\_2= 0

y^4\_7 + y^4\_10 + x^5\_8 + k\_5= 0

y^5\_0 + y^5\_10 + y^5\_13 + x^6\_0 + k\_11= 0

y^5\_1 + y^5\_11 + x^6\_13 + k\_13= 0

y^5\_2 + y^5\_8 + y^5\_15 + x^6\_2 + k\_15= 0

y^5\_3 + x^6\_7 + k\_12= 0

y^5\_3 + y^5\_9 + x^6\_15 + k\_12= 0

y^5\_7 + y^5\_10 + x^6\_8 + k\_14= 0

y^6\_0 + y^6\_10 + y^6\_13 + x^7\_0 + k\_3= 0

y^6\_2 + y^6\_8 + y^6\_15 + x^7\_2 + k\_7= 0

y^6\_7 + y^6\_10 + x^7\_8 + k\_6= 0

y^7\_0 + x^8\_4 + k\_13= 0

y^7\_2 + y^7\_8 + [y^7\_15] + [x^8\_2] + k\_11= 0

y^8\_4 + [y^8\_11] + [x^9\_9] + k\_7= 0

S(x^1\_8) + y^1\_8= 0

S(x^2\_6) + y^2\_6= 0

S(x^2\_14) + y^2\_14= 0

S(x^3\_1) + y^3\_1= 0

S(x^3\_7) + y^3\_7= 0

S(x^3\_11) + y^3\_11= 0

S(x^3\_13) + y^3\_13= 0

S(x^3\_15) + y^3\_15= 0

S(x^4\_0) + y^4\_0= 0

S(x^4\_2) + y^4\_2= 0

S(x^4\_4) + y^4\_4= 0

S(x^4\_6) + y^4\_6= 0

S(x^4\_7) + y^4\_7= 0

S(x^4\_8) + y^4\_8= 0

S(x^4\_13) + y^4\_13= 0

S(x^4\_14) + y^4\_14= 0

S(x^4\_15) + y^4\_15= 0

S(x^5\_0) + y^5\_0= 0

S(x^5\_1) + y^5\_1= 0

S(x^5\_2) + y^5\_2= 0

S(x^5\_7) + y^5\_7= 0

S(x^5\_8) + y^5\_8= 0

S(x^5\_9) + y^5\_9= 0

S(x^5\_11) + y^5\_11= 0

S(x^5\_13) + y^5\_13= 0

S(x^5\_15) + y^5\_15= 0

S(x^6\_0) + y^6\_0= 0

S(x^6\_2) + y^6\_2= 0

S(x^6\_7) + y^6\_7= 0

S(x^6\_8) + y^6\_8= 0

S(x^6\_13) + y^6\_13= 0

S(x^6\_15) + y^6\_15= 0

S(x^7\_0) + y^7\_0= 0

S(x^7\_2) + y^7\_2= 0

S(x^7\_8) + y^7\_8= 0

S(x^8\_4) + y^8\_4= 0

the 4 th Minimal Constraint set is:

y^0\_0 + [y^0\_10] + [y^0\_13] + [x^1\_0] + k\_0= 0

y^0\_0 + [x^1\_4] + k\_0= 0

the 5 th Minimal Constraint set is:

[y^4\_1] + [x^5\_5] + k\_3= 0

the 6 th Minimal Constraint set is:

[y^8\_2] + [x^9\_6] + k\_3= 0