Q1 CanPaint is not rigid, since it's true when brush is dipped in paint it then becomes false when brush is used

ColorOfBlock is also not rigid, since it goes from uncolored to some color

Q2 DipBrush

If ColorInCan = true then ~~Can~~ Can and IsColor must be true so the new precondition is

$Brush(r) \land ColorInCan(c, k)$

Paint

For paint we can remove Brush and IsColor since they are guaranteed by CanPaint

~~Q3~~ $Block(b) \land CanPaint(r, k)$

Q3 Given the initial state, I omit the rigids as described. ~~Then~~ That leaves me with:

$CanPaint(R_1, G)$

$ColorOfBlock(B_1, G)$

$ColorOfBlock(B_2, G)$

Q3

Each of these can be true or false so the total number of states is

$$2^3 = 8$$

$S_0 = \{CanPaint, ColorOfBlock1, ColorOfBlock2\}$

$$\begin{tikzcd}
 & S_0 = F,F,F \arrow[d, "DipBrush"] & \\
 & S_1 = T,F,F \arrow[dl, "DipBrush\ (loop)"'] \arrow[d, "Paint\ B_1"] \arrow[dr, "Paint\ B_2"] & \\
T,F,F & F,T,F \arrow[d, "DipBrush"] & F,F,T \arrow[d] \\
 & T,T,F \arrow[d] & T,F,T \arrow[d] \\
 & F,T,T \arrow[d] & F,T,T \arrow[dl] \\
 & T,T,T &
\end{tikzcd}$$

I just count now

States 8

~~loop~~ edge 4

Edges 16

1

min outgoing 3

max outgoing

Q4 We want to reach the goal as fast as possible, we need to Paint x2, which requires DipBrush x2, so 4 actions is most optimal.

Since we need to Paint 2 blocks the number of optimal solutions is simple, you can either start with B1 or B2, so 2 optimal solutions

Q5 Paint (B_1) & Paint (B_2) are both conflicts since they both delete CanPaint

$\neg$CanPaint(R_1, G)

So 2 conflicts

To solve the conflict, you just do the DipBrush action again. Depending on the order there are ~~3~~ then 2 ways to solve it

Q6 Goal ~~down~~ count The goals are

ColorOfBlock(B_1, G)

ColorOfBlock (B_2, G)

$h_{gc}(S_0) = 2$

Q6 Ignore-Preconditions

2 goal literals

Paint(B_1) for ColorOfBlock(B_1, G)

Paint(B_2) for ColorOfBlock(B_2, G)

$h_{ip}(S_0) = 2$

Delete Relaxation

DipBrush $\longrightarrow$ CanPaint(R_1, G)

Negative effects are ignored

So...

Paint(B_1)

Paint(B_2)

$h^+(S_0) = 3$

Additive

Cost of ColorOfBlock

first we Paint(B_1) (1 action)

Precondition to paint is CanPaint

to achieve CanPaint DipBrush is needed (1 action)

So 2 actions for ColorOfBlock

And we have 2x ColorOfBlocks so 4

$h_{add}(S_0) = 2+2 = 4$

Q6

Max

Its the same as additive except ~~when~~ I take the maximum of the subgoal costs rather than summing

$$h_{max}(s_0) = max(2,2) = 2$$

Fast forward

Similiar to delete-relaxation I ignore negative effects, so it ends like this

DipBrush

Paint (B_1)

Paint (B_2)

$$h_{ff}(s_0) = 3$$

Q7

$$\begin{tikzcd}
\text{Clean} \arrow[d, "\text{DipCleanBrush}"] \\
\text{Colored and wet} \arrow[d, "\text{Paint}"] \\
\text{Colored and not wet} \arrow[d, "\text{CleanBrush}"] \\
\text{Clean} \arrow[uu, bend right=60, dashed, "\text{Dip}"']
\end{tikzcd}$$

Q8

1 DipCleanBrush (R1, C1, G)

↓ brush R_1 is green & wet

2 Paint (B_1, R_1, G)

↓ block B_1 = Green R_1 = Green, Dry

3 DipBrush (R_1, C_1, G)

↓ R_1 wet again

4 Paint (B_2, R_1, G)

↓ B_2 = Green R_1 = Green, Dry

5 DipCleanBrush

↓

6 Paint

↓

7 CleanBrush

↓

8 DipCleanBrush

↓

9 Paint