https://github.com/t-o-k/Maxima-bezier/bezier_differentiated.wxmx

(%i1)
```
load("bezier")$
```

(%i2)
```
define(
   g(u, v),
   bezier_function_2a(
      matrix(
         [ 4, 2, 3, 5 ],
         [ 5, 3, 2, 4 ],
         [ 2, 5, 4, 3 ],
         [ 3, 4, 5, 2 ]
      ),
      u, v
   )
)$
```

(%i3)
```
define(der_u_g(u, v), diff(g(u, v), u))$
```

(%i4)
```
define(der_v_g(u, v), diff(g(u, v), v))$
```

(%i5)
```
define(der2_u_g(u, v), diff(g(u, v), u, 2))$
```

(%i6)
```
define(der2_v_g(u, v), diff(g(u, v), v, 2))$
```

(%i7)
```
define(der_u_der_v_g(u, v), diff(diff(g(u, v), u), v))$
```

(%i8)
```
define(der_v_der_u_g(u, v), diff(diff(g(u, v), v), u))$
```

(%i9)
```
expand(g(u, v));
```

(%o9)
$$-8\,u^3\,v^3+36\,u^2\,v^3-36\,u\,v^3+8\,v^3-6\,u^3\,v^2-27\,u^2\,v^2+45\,u\,v^2-12\,v^2+12\,u^3\,v-18\,u^2\,v+3\,v-2\,u^3+9\,u^2-6\,u+4$$

(%i10)
```
expand(der_u_g(u, v));
```

(%o10)
$$-24\,u^2\,v^3+72\,u\,v^3-36\,v^3-18\,u^2\,v^2-54\,u\,v^2+45\,v^2+36\,u^2\,v-36\,u\,v-6\,u^2+18\,u-6$$

```
(%i11) expand(der_v_g(u, v));
```

$$(\%o11)\quad -24\,u^3\,v^2+108\,u^2\,v^2-108\,u\,v^2+24\,v^2-12\,u^3\,v-54\,u^2\,v+90\,u\,v-24\,v+12\,u^3-18\,u^2+3$$

```
(%i12) expand(der2_u_g(u, v));
```

$$(\%o12)\quad -48\,u\,v^3+72\,v^3-36\,u\,v^2-54\,v^2+72\,u\,v-36\,v-12\,u+18$$

```
(%i13) expand(der2_v_g(u, v));
```

$$(\%o13)\quad -48\,u^3\,v+216\,u^2\,v-216\,u\,v+48\,v-12\,u^3-54\,u^2+90\,u-24$$

```
(%i14) expand(der_u_der_v_g(u, v));
```

$$(\%o14)\quad -72\,u^2\,v^2+216\,u\,v^2-108\,v^2-36\,u^2\,v-108\,u\,v+90\,v+36\,u^2-36\,u$$

```
(%i15) expand(der_v_der_u_g(u, v));
```

$$(\%o15)\quad -72\,u^2\,v^2+216\,u\,v^2-108\,v^2-36\,u^2\,v-108\,u\,v+90\,v+36\,u^2-36\,u$$

```
(%i16) define(
         f(s, t),
         bezier_function_2a(
           matrix(
             [ a_11, a_12, a_13, a_14 ],
             [ a_21, a_22, a_23, a_24 ],
             [ a_31, a_32, a_33, a_34 ]
           ),
           s, t
         )
       )$
```

(%i17) expand(f(s, t));

(%o17) $$a_{34}\,s^3\,t^2-3\,a_{33}\,s^3\,t^2+3\,a_{32}\,s^3\,t^2-a_{31}\,s^3\,t^2-2\,a_{24}\,s^3\,t^2+6\,a_{23}\,s^3\,t^2-6\,a_{22}\,s^3\,t^2+2\,a_{21}\,s^3\,t^2+a_{14}\,s^3\,t^2-3\,a_{13}\,s^3\,t^2+3\,a_{12}\,s^3\,t^2-a_{11}\,s^3\,t^2+3\,a_{33}\,s^2\,t^2-6\,a_{32}\,s^2\,t^2+3\,a_{31}\,s^2\,t^2-6\,a_{23}\,s^2\,t^2+12\,a_{22}\,s^2\,t^2-6\,a_{21}\,s^2\,t^2+3\,a_{13}\,s^2\,t^2-6\,a_{12}\,s^2\,t^2+3\,a_{11}\,s^2\,t^2+3\,a_{32}\,s\,t^2-3\,a_{31}\,s\,t^2-6\,a_{22}\,s\,t^2+6\,a_{21}\,s\,t^2+3\,a_{12}\,s\,t^2-3\,a_{11}\,s\,t^2+a_{31}\,t^2-2\,a_{21}\,t^2+a_{11}\,t^2+2\,a_{24}\,s^3\,t-6\,a_{23}\,s^3\,t+6\,a_{22}\,s^3\,t-2\,a_{21}\,s^3\,t-2\,a_{14}\,s^3\,t+6\,a_{13}\,s^3\,t-6\,a_{12}\,s^3\,t+2\,a_{11}\,s^3\,t+6\,a_{23}\,s^2\,t-12\,a_{22}\,s^2\,t+6\,a_{21}\,s^2\,t-6\,a_{13}\,s^2\,t+12\,a_{12}\,s^2\,t-6\,a_{11}\,s^2\,t+6\,a_{22}\,s\,t-6\,a_{21}\,s\,t-6\,a_{12}\,s\,t+6\,a_{11}\,s\,t+2\,a_{21}\,t-2\,a_{11}\,t+a_{14}\,s^3-3\,a_{13}\,s^3+3\,a_{12}\,s^3-a_{11}\,s^3+3\,a_{13}\,s^2-6\,a_{12}\,s^2+3\,a_{11}\,s^2+3\,a_{12}\,s-3\,a_{11}\,s+a_{11}$$

(%i18) expand(f(0, 0));

(%o18) a_{11}

(%i19) expand(f(0, 1));

(%o19) a_{31}

(%i20) expand(f(1, 0));

(%o20) a_{14}

(%i21) expand(f(1, 1));

(%o21) a_{34}

(%i22) expand(f(u, 0));

(%o22) $$a_{14}\,u^3-3\,a_{13}\,u^3+3\,a_{12}\,u^3-a_{11}\,u^3+3\,a_{13}\,u^2-6\,a_{12}\,u^2+3\,a_{11}\,u^2+3\,a_{12}\,u-3\,a_{11}\,u+a_{11}$$

(%i23) expand(f(u, 1));

(%o23) $$a_{34}\,u^3-3\,a_{33}\,u^3+3\,a_{32}\,u^3-a_{31}\,u^3+3\,a_{33}\,u^2-6\,a_{32}\,u^2+3\,a_{31}\,u^2+3\,a_{32}\,u-3\,a_{31}\,u+a_{31}$$

```
(%i24) expand(f(0, v));
```

$$(\%o24)\quad a_{31}\,v^2-2\,a_{21}\,v^2+a_{11}\,v^2+2\,a_{21}\,v-2\,a_{11}\,v+a_{11}$$

```
(%i25) expand(f(1, v));
```

$$(\%o25)\quad a_{34}\,v^2-2\,a_{24}\,v^2+a_{14}\,v^2+2\,a_{24}\,v-2\,a_{14}\,v+a_{14}$$