```
1   OICD_UI <- dashboardPage(
2     dashboardHeader(title = "Portfolio Choice"),
3
4     dashboardSidebar(
5       sidebarMenu(
6
7         menuItem("Task", tabName = "Task",
8                  icon=icon("list")),
9         menuItem("Scenario 1", tabName = "Risky_Visualisierung",
10                 icon=icon("chart-line")),
11        menuItem("Scenario 2", tabName = "Riskless_Visualisierung",
12                 icon=icon("chart-line"))
13       )
14    ),
15
16    dashboardBody(
17      withMathJax(),
18      tags$head(
19        tags$style(
20          HTML(
21            ".MathJax {
22              font-size: 5pt !important;
23            }"
24          )
25        )
26      ),
27      tabItems(
28
29  # Aufgabenstellung ----------------------------------------------------------
30        tabItem(tabName = "Task",
31                h2("Portfolio-Choice: Optimal Investment-Consumption Decision"),
32                fluidRow(width=12,
33                         box(width=12,title="Risky investment",
34                             p("A risk averse Investor is endowed with capital
35                               \\(K\\). He/she must now decide on immediate
36                               consumption, \\(c_0\\), and on how much should
37                               optimally be invested in an investment opportunity
38                               that provides a risky dividend which can be
39                               consumed tomorrow. Thus, consumption \\(c_1\\)
40                               at \\(t=1\\) is stochastic."),
41                             p("The investor seeks to maximize expected utility
42                               \\(E[U(c_0,c_1)]\\)."),
43                             p("More specific: The investor has time-seperable
44                               utility with constant relative risk aversion
45                               (CRRA)"),
46                             p("\\(U(c_0, c_1) = u(c_0) + \\beta \\,
47                               E[u(c_1)],\\)"),
48                             tags$ul(
49                               tags$li("\\(c_0, c_1 > 0\\),"),
50                               tags$li("\\(\\beta \\leq 1\\),"),
51                               tags$li("\\(\\gamma > 0\\).")
52                             ),
53
54                             p("There is no income at \\(t=1\\), so investment
55                               today is the only way to get consumption
56                               tomorrow."),
57                             p("The risky investment has a price \\(p_0\\). The
58                               payoff (dividend) of the investment, however, is
59                               not deterministic."),
60                             p("We assume that at \\(t=1\\), \\(N\\) different
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61                                      states may occur \\(\\Rightarrow\\)
62                                      \\(\\pi=[\\pi_1, \\pi_2, ..., \\pi_N]\\),
63                                      \\(d_1=[d_{1,1}, d_{1,2}, ..., d_{1,N}]\\)
64                                      with \\(d_{1,i}>0\\) and
65                                      \\(\\sum_{i=1}^{N}\\pi_i=1.\\)"),
66                                  p("Buying \\(x\\) units of the risky investment then
67                                      yields a dividend payment of \\(xd_{1,i}\\) in
68                                      state \\(i\\)."),
69                                  p("The investment problem is then"),
70                                  p("\\(E[U(c_0, c_1)] = u(c_0) + \\beta
71                                      \\sum_{i=1}^{N}\\pi_i u(c_{1,i}) \\rightarrow
72                                      max_{c_0, c_{1,i}}\\)"),
73                                  tags$ul(
74                                      tags$li("\\(c_0 = K - xp_0\\),"),
75                                      tags$li("\\(c_{1,i} = xd_{1,i}\\),"),
76                                      tags$li("\\(x \\geq 0\\).")
77                                  )
78                              ),
79
80                              box(width=12,title="Risky and riskless Investment",
81                                  p("Now we assume that investors have in addition to
82                                      the risky investment also a riskless investment."),
83                                  p("Paying a price of \\(b_0\\) at \\(t=0\\), the
84                                      investor receives a fixed payment of \\(1\\) in each
85                                      state at \\(t=1\\)."),
86                                  p("The new optimization problem, which is to maximize
87                                      by deciding the magnitude of the risky investment,
88                                      \\(x\\), and the riskless investment, \\(y\\), is
89                                      then"),
90                                  p("\\(E[U(c_0, c_1)] = u(c_0) + \\beta
91                                      \\sum_{i=1}^{N}\\pi_i u(c_{1,i}) \\rightarrow
92                                      max_{c_0, c_{1,i}}\\)"),
93                                  tags$ul(
94                                      tags$li("\\(c_0 = K - xp_0 - yb_0\\),"),
95                                      tags$li("\\(c_{1,i} = xd_{1,i} + y \\cdot 1\\),"),
96                                      tags$li("\\(x \\geq 0\\),"),
97                                      tags$li("\\(y \\geq 0\\).")
98                                          )
99                                  )
100             )
101     ),
102
103
104 # Risky Visualisierung -------------------------------------------------------
105     tabItem(tabName = "Risky_Visualisierung",
106             h2("Plot of the total expected utility:"),
107             fluidRow(
108                 column(width=3,
109                         box(width=NULL,title= "Parameters",
110                             sliderInput(inputId= "capital_x",
111                                         label="capital",
112                                         min = 1,
113                                         max = 100,
114                                         step = 1,
115                                         value = 20),
116                             sliderInput(inputId = "price_x",
117                                         label= "price",
118                                         min = 1,
119                                         max = 100,
120                                         step = 1,
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121                                           value = 19),
122                           sliderInput(inputId = "beta_x",
123                                       label= "discount factor",
124                                       min = 0,
125                                       max = 1,
126                                       step = 0.01,
127                                       value = 0.9),
128                           sliderInput(inputId = "gamma_x",
129                                       label= "constant relative risk aversion",
130                                       min = 0.01,
131                                       max = 5,
132                                       step = 0.01,
133                                       value = 2),
134                       ),
135
136                   box(inputId = "Isoquant_delta",  width=NULL,
137
138                       sliderInput(inputId = "delta_x",
139                                   label= "isoquant delta",
140                                   min = -0.8,
141                                   max = 0.8,
142                                   step = 0.1,
143                                   value = 0)
144                       ),
145
146                   box(width=NULL,
147                       actionButton(inputId= "setToDefault_Parameter_x",
148                                    label= "reset", width = '40%'),
149                                    align = "center",
150                       ),
151
152                   box(inputId = "Investment_box_x",
153                       width=NULL, title= "Investment details",
154
155                       sliderInput(inputId = "probability1_x",
156                                   label= "probability1",
157                                   min = 0,
158                                   max = 1,
159                                   step = 0.01,
160                                   value = 0.2),
161
162                       sliderInput(inputId= "dividend1_x",
163                                   label="dividend1",
164                                   min = 1,
165                                   max = 100,
166                                   step= 1,
167                                   value = 5),
168
169                       sliderInput(inputId = "probability2_x",
170                                   label= "probability2",
171                                   min = 0,
172                                   max = 1,
173                                   step = 0.01,
174                                   value = 0.5),
175
176                       sliderInput(inputId= "dividend2_x",
177                                   label="dividend2",
178                                   min = 1,
179                                   max = 100,
180                                   step= 1,
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181                                              value = 15),
182
183                                sliderInput(inputId = "probability3_x",
184                                            label= "probability3",
185                                            min = 0,
186                                            max = 1,
187                                            step = 0.01,
188                                            value = 0.3),
189
190                                sliderInput(inputId= "dividend3_x",
191                                            label="dividend3",
192                                            min = 1,
193                                            max = 100,
194                                            step= 1,
195                                            value = 25)
196                          ),
197                          box(width=NULL,
198                              actionButton(inputId= "setToDefault_investment_x",
199                                           label= "reset", width = '40%'),
200                              align = "center",
201                          ),
202                          box(width=NULL,title="results",
203                              htmlOutput("max_x"),
204                              htmlOutput("maxZf_x")
205                              )
206                  ),
207                  column(width=9,
208                          box(width=NULL,
209                              plotOutput(outputId = "PortfolioChoice_x",
210                                         height="55vh"))
211                  ),
212                  column(width=9,
213                          box(width=NULL,
214                              plotOutput(outputId = "Isoquants_x",height="55vh"))
215                  ),
216                  column(width=9,
217                          box(width=NULL,
218                              plotOutput(outputId = "MarginalUtility_x",
219                                         height="55vh"))
220                  )
221              )
222      ),
223
224
225 # Riskless Visualisierung -------------------------------------------------
226
227 tabItem(tabName = "Riskless_Visualisierung",
228        h2("Plot of the total expected utility:"),
229        fluidRow(
230          column(width=3,
231
232                  box(width=NULL,title= "Parameters",
233                      sliderInput(inputId = "capital_xy",
234                                  label="capital",
235                                  min = 1,
236                                  max = 100,
237                                  step = 1,
238                                  value = 20),
239                      sliderInput(inputId = "price_p0_xy",
240                                  label= "price risky investment",
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```
241                                      min = 1,
242                                      max = 100,
243                                      step = 1,
244                                      value = 19),
245              sliderInput(inputId = "price_b0_xy",
246                              label= "price riskless investment",
247                              min = 0.05,
248                              max = 5,
249                              step = 0.05,
250                              value = 0.95),
251              sliderInput(inputId = "beta_xy",
252                              label= "discount factor",
253                              min = 0,
254                              max = 1,
255                              step = 0.01,
256                              value = 0.9),
257              sliderInput(inputId = "gamma_xy",
258                              label= "constant relative risk aversion",
259                              min = 0.01,
260                              max = 5,
261                              step = 0.01,
262                              value = 2),
263          ),
264
265          box(inputId = "Isoquant_delta_xy",  width=NULL,
266
267              sliderInput(inputId = "delta_xy",
268                              label= "isoquant delta y",
269                              min = -1,
270                              max = 1,
271                              step = 0.05,
272                              value = 0)
273          ),
274
275          box(width=NULL,
276              actionButton(inputId= "setToDefault_Parameter_xy",
277                              label= "reset", width = '40%'),
278              align = "center",
279          ),
280
281          box(inputId = "Investment_box_xy",  width=NULL,
282              title= "Investment details",
283
284              sliderInput(inputId = "probability1_xy",
285                              label= "probability1",
286                              min = 0,
287                              max = 1,
288                              step = 0.01,
289                              value = 0.2),
290
291              sliderInput(inputId= "dividend1_xy",
292                              label="dividend1",
293                              min = 1,
294                              max = 100,
295                              step= 1,
296                              value = 5),
297
298              sliderInput(inputId = "probability2_xy",
299                              label= "probability2",
300                              min = 0,
```

```
301                                       max = 1,
302                                       step = 0.01,
303                                       value = 0.5),
304
305                         sliderInput(inputId= "dividend2_xy",
306                                     label="dividend2",
307                                     min = 1,
308                                     max = 100,
309                                     step= 1,
310                                     value = 15),
311
312                         sliderInput(inputId = "probability3_xy",
313                                     label= "probability3",
314                                     min = 0,
315                                     max = 1,
316                                     step = 0.01,
317                                     value = 0.3),
318
319                         sliderInput(inputId= "dividend3_xy",
320                                     label="dividend3",
321                                     min = 1,
322                                     max = 100,
323                                     step= 1,
324                                     value = 25)
325                     ),
326                 box(width=NULL,
327                     actionButton(inputId= "setToDefault_investment_xy",
328                                  label= "reset", width = '40%'),
329                     align = "center",
330                 ),
331                 box(width=NULL,title="results",
332                     htmlOutput("max_xy_x"),
333                     htmlOutput("max_xy_y"),
334                     htmlOutput("maxZf_xy")
335                     )
336         ),
337
338         column(width=9,
339                 box(width=NULL,
340                     plotOutput(outputId = "PortfolioChoice_xy",
341                                height="55vh"))
342         ),
343
344         column(width=9,
345                 box(width=NULL,
346                     plotOutput(outputId = "Isoquants_xy", height="55vh"))
347         ),
348
349         column(width=9,
350                 box(width=NULL,
351                     plotOutput(outputId = "MarginalUtility_xy",
352                                height="55vh"))
353         )
354       )
355     )
356   )
357 )
358 )
```