CMMN Survey statistics

Mike A. Marin

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Contents

1 Introduction

This document contains a basic set of statistics for the CMMN complexity metrics survey. The survey was distributed using snowball sampling, in which email to potential subjects has been used and the same users have been asked to further distribute the survey. Twitter, Blogs, and LinkedIn posts have also been used to spread the words about the survey.

The breakdown of participation is as follows,

```
Survey Totals:
    106    Completed surveys
    108    Provided valid data (includes incomplete surveys)

    333   Started the survey (passed page 1)
    257   Agreed to informed consent (passed page 2)
    75    Did not answer inform consent (stopped at page 2)
    75    Did not complete demographics (stopped at page 3)
    150   Completed tutorial (passed page 4)
```

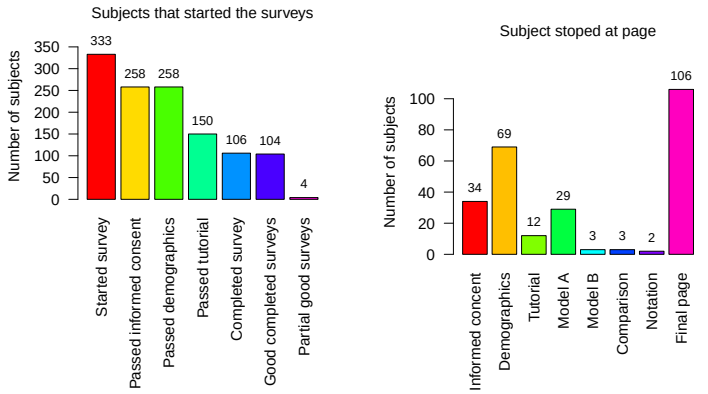
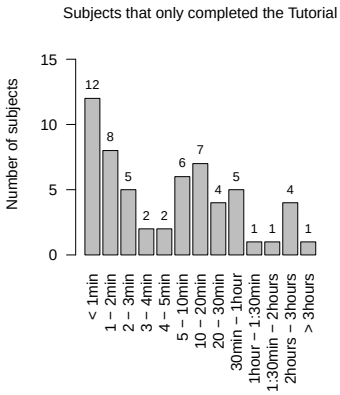


Figure 1: Number of surveys

```
Subjects that only completed the Tutorial time:
     N      58
     min    00:00:00 ~ 0 minutes
     median 00:05:08 ~ 5 minutes
     max    08:03:27 ~ 483 minutes
     mean   00:31:00 ~ 31 minutes
     sd     01:14:17 ~ 74 minutes
```

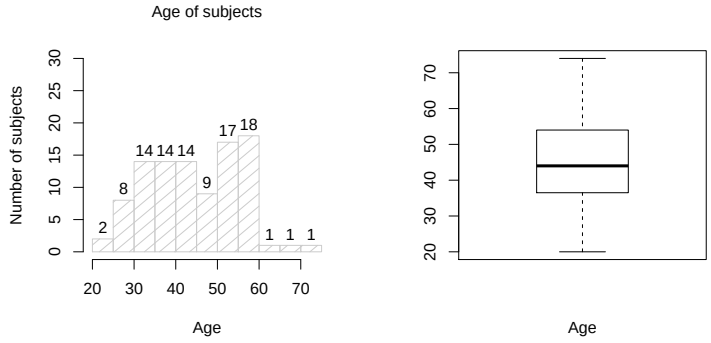


2 Basic Statistics

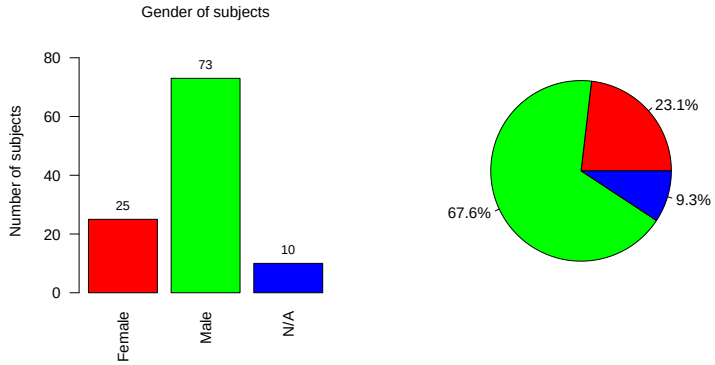
Here we print some basic statistics about the demographics and prior experience for the 108 surveys that provided valid information.

2.1 Age of Subjects

9 subjects did not provide their age.

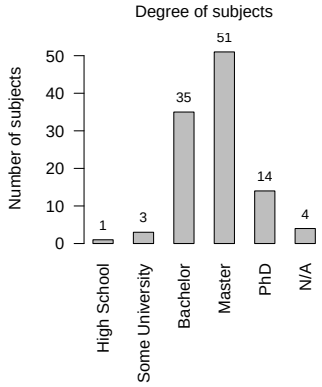


2.2 Gender of Subjects



2.3 Degree of Subjects

Question was: Highest degree completed?

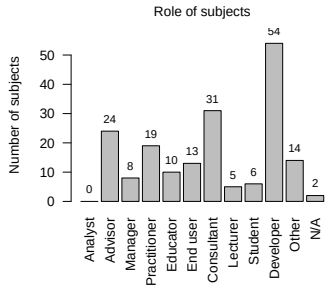


2.4 Role of Subjects

Question was: Current role?

```
Roles:
    Analyst:      Market analyst
    Advisor:      Advise clients on process technology
    Manager:      Manager
    Practitioner: Practitioner (creates process models)
    Educator:     Educator (trains clients on modeling technologies)
    End user:     End user of process technology
    Consultant:   Consultant on process technology
    Lecturer:     University lecturer
    Student:      University student
    Developer:    Designer or developer of process technology products
```

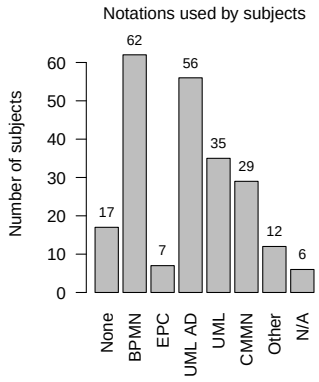
```
    Others:       Business Systems Consultant,
                  IIT specialist,
                  implementation provider,
                  Tecnico,
                  Director architecture,
                  Technician Support Representative ,
                  Consultant ECM technology,
                  Gen consultant,
                  Past advisor of clients on process technology,
                  business consultant,
                  researcher,
                  business consultant,
                  Software Developer,
                  Consultant - Technology and Business,
```



2.5 Notations Used by Subjects

Question was: Process model notation used?

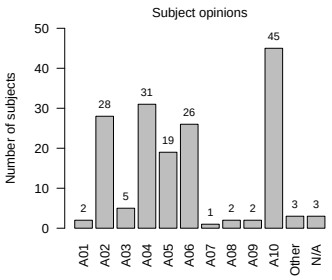
```
Notations:
    Others: Data Flow Diagrams (context models), state diagrams, ,
                  YAWL,
                  BPEL,
                  BPEL, XPDL,
                  Flow Charts,
                  RADs,
                  Decision Model Notation (DMN); Yet Another Workflow Language (YAWL),
                  Filenet proprietary,
                  IDEF,
                  artifact centric appraoch,
                  ArchiMate,
                  BPEL,
```



2.6 Opinions of Subjects

Question was: What statements better reflects your current opinion?

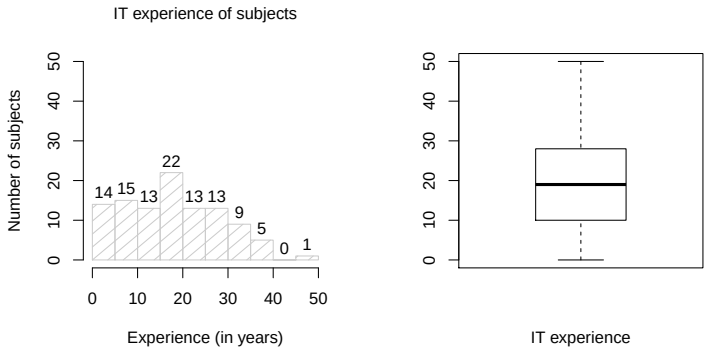
```
Opinions:
    A01:   Adaptive case management cannot be modeled in advance
    A02:   Some initial modeling is required for adaptive case management
    A03:   BPMN is enough to model adaptive case management
    A04:   BPMN is not enough for adaptive case management
    A05:   BPMN and CMMN should be merged into a single standard
    A06:   BPMN and CMMN should be maintained as separate standards
    A07:   CMMN is irrelevant
    A08:   BPMN is irrelevant
    A09:   Both CMMN and BPMN are irrelevant for adaptive case management
    A10:   I do not know enough about CMNN to answer the question
    Other: CMMN wil transform knowledge management,
                  Adaptive case management SHOULD NOT be modeled in advance,
                  I don't have enough experience in BPNM or CMMN,
```



2.7 Work Experience of Subjects

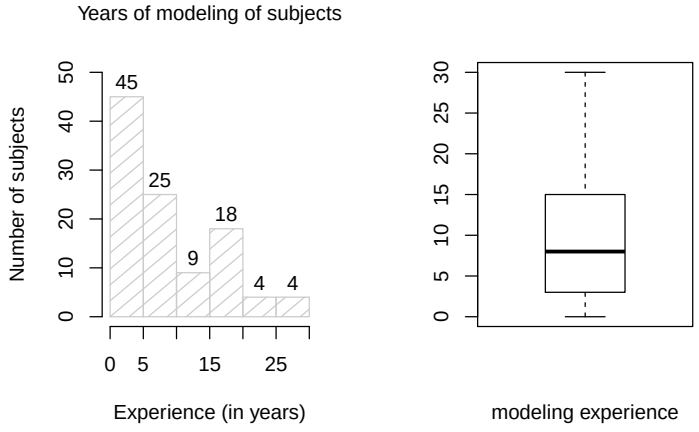
2.7.1 IT Experience

Question was: Work experience in the IT-sector? (in years)
3 subjects did not provide an answer, and 10 has zero IT experience.



2.7.2 Years of Modeling

Question was: Work experience with process (or workflow) models? (in years)
3 subjects did not provide an answer, and 12 has zero modeling experience.

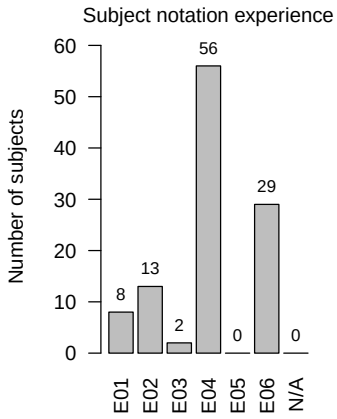


2.7.3 Modeling Experience

Calculated variable using notation used, years of modeling, and formal modeling training.

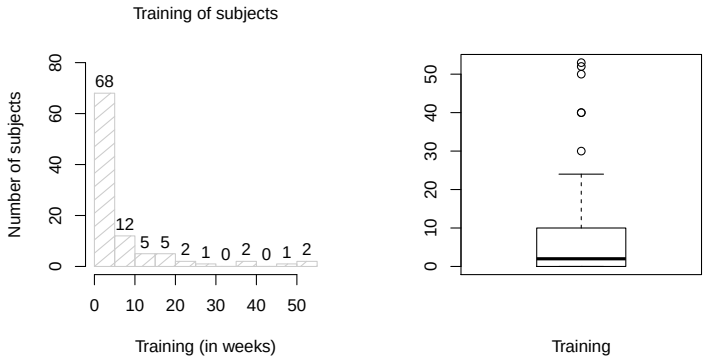
```
Opinions:
    E01:   No notation experience
```

```
E02:   Not using a notation, but has training or experience
E03:   Using a notation (no CMMN) without any training or experiencet
E04:   Using a notation (no CMMN) with some training or experience
E05:   Using CMMN, but without training or experience
E06:   Using CMMN and has training or experience
```



2.8 Formal Training of Subjects

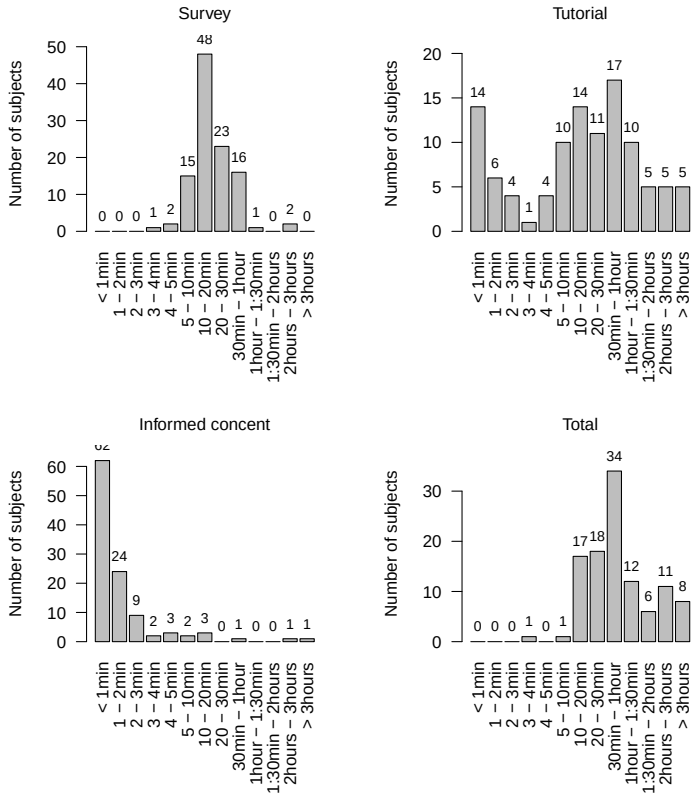
Question was: Formal training on process (or workflow) modeling? (in weeks)
10 subjects did not provide an answer, and 38 has zero formal training.



2.9 Duration

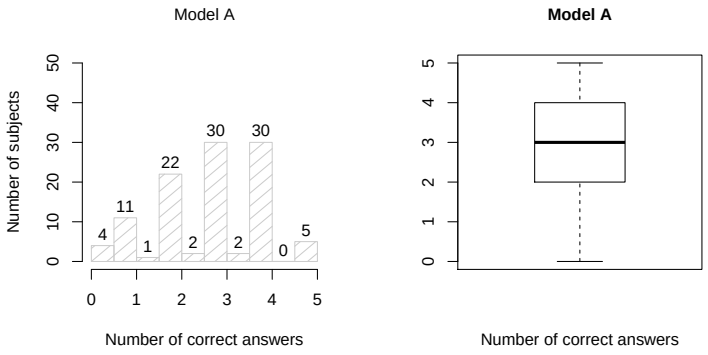
Duration is given in hh:mm:ss (hours, minutes, and seconds), and in minutes.
Note that subjects had the ability to do the survey in multiple sessions.

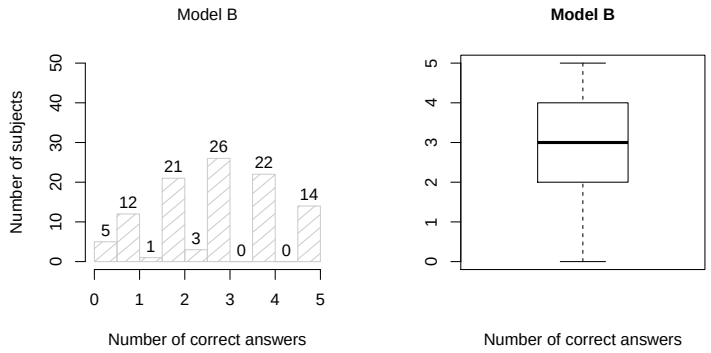
```
Survey time:
     N      108
     min    00:03:18 ~ 3 minutes
     median 00:16:50 ~ 17 minutes
     max    02:59:09 ~ 179 minutes
     mean   00:22:05 ~ 22 minutes
     sd     00:22:10 ~ 22 minutes
Tutorial time:
     N      106
     min    00:00:10 ~ 0 minutes
     median 00:19:55 ~ 20 minutes
     max    06:05:28 ~ 365 minutes
     mean   00:44:21 ~ 44 minutes
     sd     01:07:22 ~ 67 minutes
Informed concent time:
     N      108
     min    00:00:05 ~ 0 minutes
     median 00:00:41 ~ 1 minutes
     max    05:07:01 ~ 307 minutes
     mean   00:05:39 ~ 6 minutes
     sd     00:31:41 ~ 32 minutes
Total time:
     N      108
     min    00:03:53 ~ 4 minutes
     median 00:39:33 ~ 40 minutes
     max    06:36:56 ~ 397 minutes
     mean   01:11:15 ~ 71 minutes
     sd     01:18:51 ~ 79 minutes
```



2.10 Correct Answers

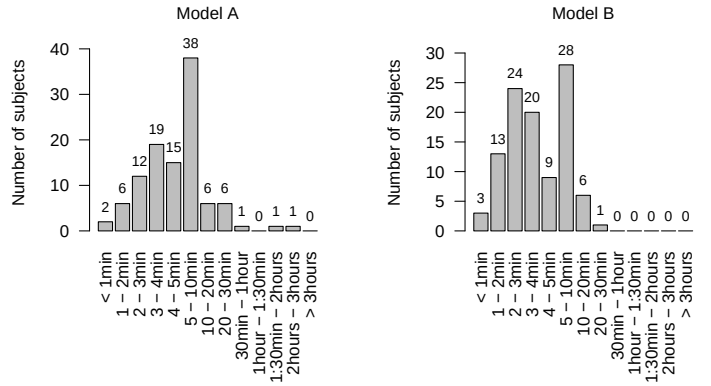
Subjects were exposed to two models, model A and model B. Five questions were asked for each model. Each question had a one point value. One question was evaluated with .25, .50, .75, and 1. Therefore, correct answers range from 0.25 to 5 points.





The time used working on each model was recorded.

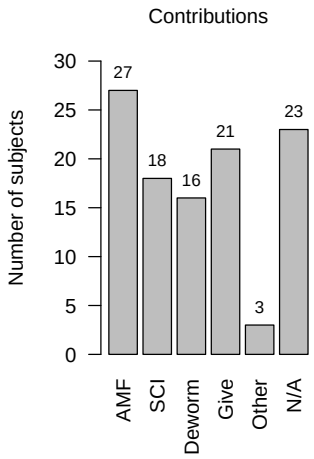
```
Model A time:
     N      107
     min    00:00:18 ~ 0 minutes
     median 00:04:48 ~ 5 minutes
     max    02:50:49 ~ 171 minutes
     mean   00:09:22 ~ 9 minutes
     sd     00:19:57 ~ 20 minutes
Model B time:
     N      104
     min    00:00:10 ~ 0 minutes
     median 00:03:33 ~ 4 minutes
     max    00:26:02 ~ 26 minutes
     mean   00:04:35 ~ 5 minutes
     sd     00:03:33 ~ 4 minutes
```



3 Charitable Contributions

```
Charitable organizations:
    AMF:    Against Malaria Foundation
    SCI:    Schistosomiasis Control Initiative
    Deworm: Deworm the World Initiative
    Give:   GiveDirectly
    Other: http://www.choc.org/giving/,
                heretoserve.org,
                AlZ.org,

Contributions:
    AMF:    $ 162
    SCI:    $ 108
    Deworm: $ 96
    Give:   $ 126
    Other:  $ 18
            -------
    TOTAL:  $ 510
```



4 Hypothesis Testing

This section complements **??**.

4.1 Descriptive Statistics

The descriptive statistics of the main dependent variables (see **??**) are presented here. Table 1 shows the descriptive statistics for the ratio scale dependent variables, while Table 2 shows the descriptive statistics for the ordinal scale dependent variables.

Table 1: Descriptive statistics for ratio scale variables

Name	N	min	max	mean	sd	sem
A.Correct	99	0.000	5.000	2.869	1.143	0.115
A.Time	99	127.580	10248.900	600.818	1236.583	124.281
A.Efficacy	99	0.000	1.000	0.574	0.229	0.023
A.Efficiency	99	0.000	0.029	0.009	0.006	0.001
B.Correct	88	0.000	5.000	2.977	1.333	0.142
B.Time	88	121.100	1561.950	309.294	213.347	22.743
B.Efficacy	88	0.000	1.000	0.595	0.267	0.028
B.Efficiency	88	0.000	0.034	0.012	0.008	0.001

Table 2: Descriptive statistics for ordinal scale variables

Name	N	min	max	median	mode
C.Compare	105	1	9	5.00	3
A.perceived	98	1	7	3.00	3
B.perceived	88	1	7	3.00	3
Weights.CasePlan	10	1	4	1.00	1
Weights.Stage	6	1	3	2.00	2
Weights.DStage	13	1	5	2.00	1
Weights.PlanFrag	11	2	7	3.00	3
Weights.CFileItem	12	1	5	2.00	1
Weights.Task	15	1	5	2.00	1
Weights.DTask	13	1	5	3.00	2
Weights.NBHTask	10	1	6	3.50	1
Weights.ProcTask	8	1	7	2.50	2
Weights.CaseTask	13	1	7	3.00	3
Weights.CaseTasknim	12	1	7	3.50	3
Weights.BHTask	6	1	5	2.00	2
Weights.Event	12	1	8	3.00	3
Weights.UserEvent	13	1	4	2.00	2
Weights.TimerEvent	12	1	4	2.00	2
Weights.Milestone	11	1	5	2.00	1
Weights.Connector	10	1	5	1.50	1
Weights.HumanIcon	12	1	5	1.00	1
Weights.CPlanningT	12	2	7	3.00	3
Weights.EPlanningT	7	1	8	3.00	1
Weights.AComplete	10	1	6	3.50	5
Weights.Collapsed	10	1	7	2.50	1
Weights.Expanded	10	1	8	2.00	1
Weights.ManualA	11	1	6	3.00	2
Weights.Repetition	9	1	7	1.00	1
Weights.Required	14	1	6	2.00	1

Weights.EntryCritWC	8	1	6	3.50	4
Weights.EntryCrit	8	1	3	2.00	2
Weights.ExitCritWC	7	2	7	3.00	2
Weights.ExitCrit	12	1	6	2.50	3
Weights.EntryCritAND	8	1	6	2.00	2
Weights.EntryCritOR	9	2	7	2.00	2
Weights.ExitCritAND	9	1	4	3.00	2
Weights.ExitCritOR	8	1	6	2.00	2

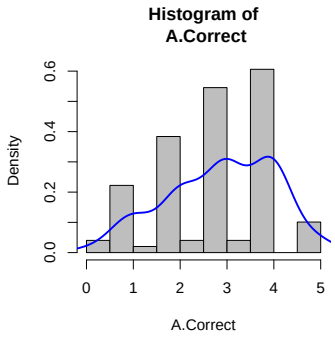
The variable C.Compare records the comparison for 15 groups. Table 3 shows descriptive statistics for each group.

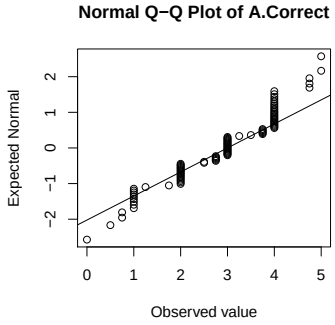
Table 3: C.Compare group descriptive statistics

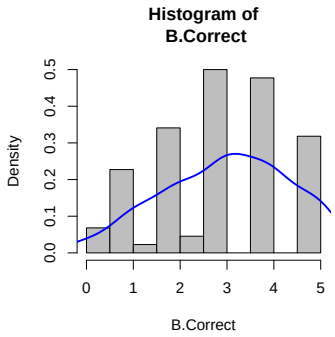
Group	N	Mean	SD
m5vs4	8	4.125	2.416
m6vs1	9	4.222	1.986
m6vs2	9	4.667	2.062
m2vs1	8	4.625	2.264
m3vs1	9	4.556	2.506
m4vs1	5	4.400	2.191
m3vs2	8	5.250	1.669
m5vs2	5	6.200	1.483
m6vs5	5	4.000	1.732
m6vs3	10	4.900	1.969
m4vs2	5	4.600	1.517
m4vs3	7	5.286	1.976
m5vs1	7	5.714	2.059
m6vs4	6	4.167	1.329
m5vs3	4	5.250	1.708

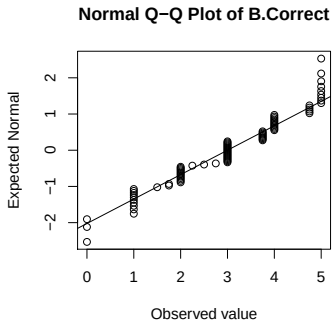
4.2 Normality Plots

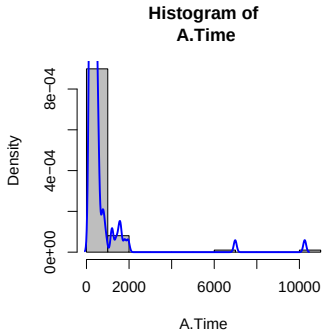
The following plots consist of a histogram with an over-imposed density graph in blue and a normal Q-Q plot for each dependent variable. The plots for time (A.Time and B.Time) to indicate substantial non-normality of these variables. The plots for the other variables also indicate non-normality. Therefore, due to the presence of non-normality among these dependent variables, a series of Spearman's correlations tests were conducted to test the hypothesis involving ratio scale dependent variables.

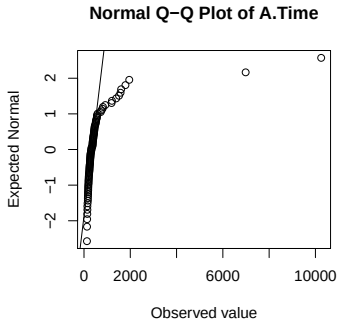

Histogram of
A.Correct
Density
0.0
0.2
0.4
0.6
0
1
2
3
4
5
A.Correct

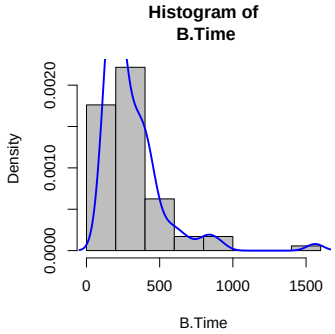

Normal Q−Q Plot of A.Correct
Expected Normal
−2
−1
0
1
2
0
1
2
3
4
5
Observed value

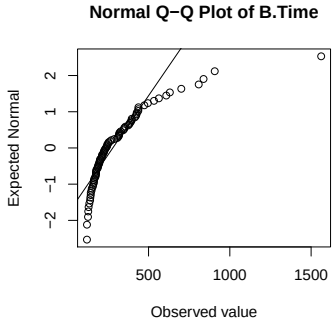

Histogram of
B.Correct
Density
0.0
0.1
0.2
0.3
0.4
0.5
0
1
2
3
4
5
B.Correct

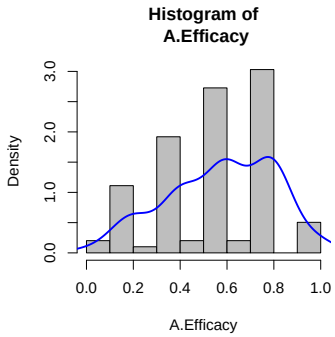

Normal Q−Q Plot of B.Correct
Expected Normal
−2
−1
0
1
2
0
1
2
3
4
5
Observed value

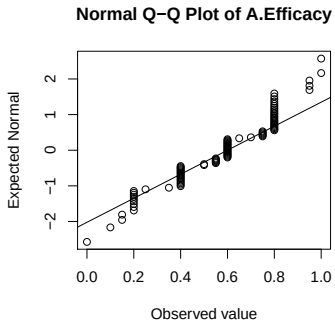

Histogram of
A.Time
Density
0e+00
4e−04
8e−04
0
2000
6000
10000
A.Time

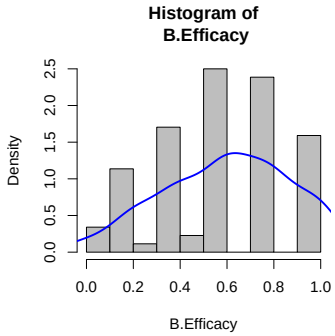

Normal Q−Q Plot of A.Time
Expected Normal
−2
−1
0
1
2
0
2000
6000
10000
Observed value

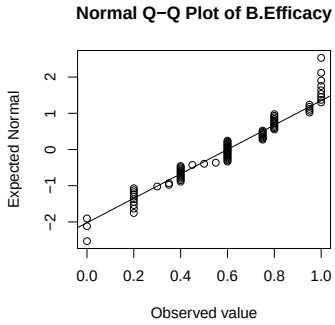

Histogram of
B.Time
Density
0.0000
0.0010
0.0020
0
500
1000
1500
B.Time

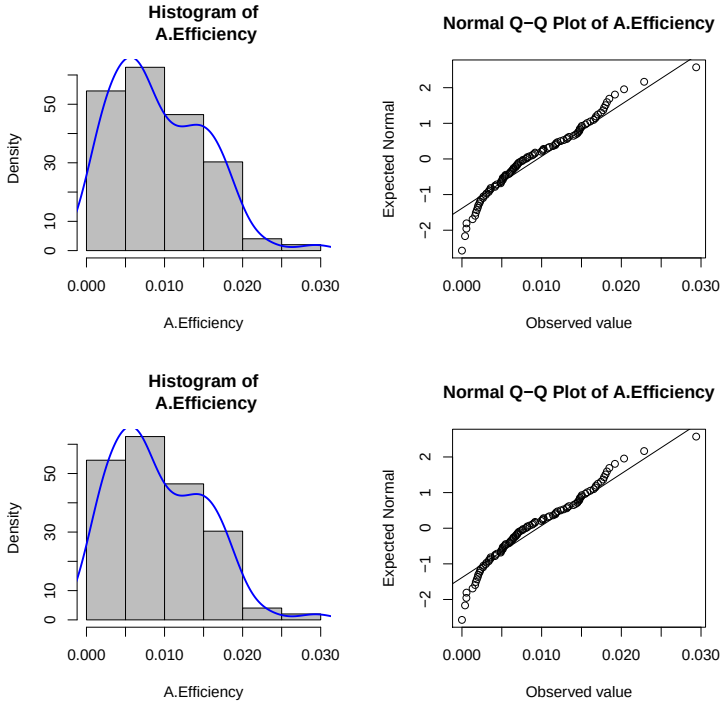

Normal Q−Q Plot of B.Time
Expected Normal
−2
−1
0
1
2
500
1000
1500
Observed value


Histogram of
A.Efficacy
Density
0.0
1.0
2.0
3.0
0.0
0.2
0.4
0.6
0.8
1.0
A.Efficacy

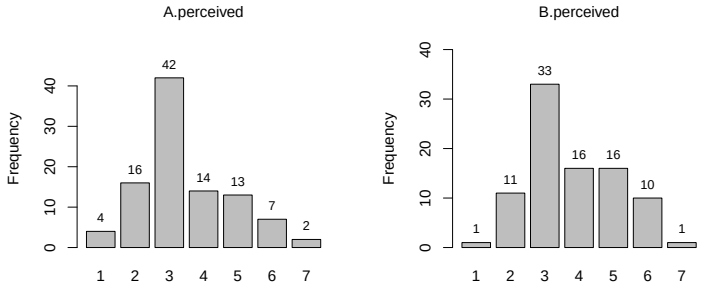

Normal Q−Q Plot of A.Efficacy
Expected Normal
−2
−1
0
1
2
0.0
0.2
0.4
0.6
0.8
1.0
Observed value

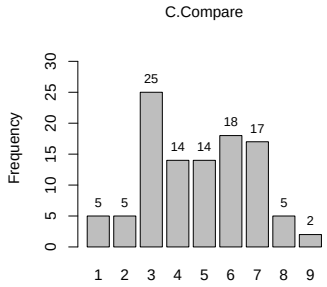

Histogram of
B.Efficacy
Density
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.2
0.4
0.6
0.8
1.0
B.Efficacy


Normal Q−Q Plot of B.Efficacy
Expected Normal
−2
−1
0
1
2
0.0
0.2
0.4
0.6
0.8
1.0
Observed value



For ordinal scale dependent variables frequency plots were used.

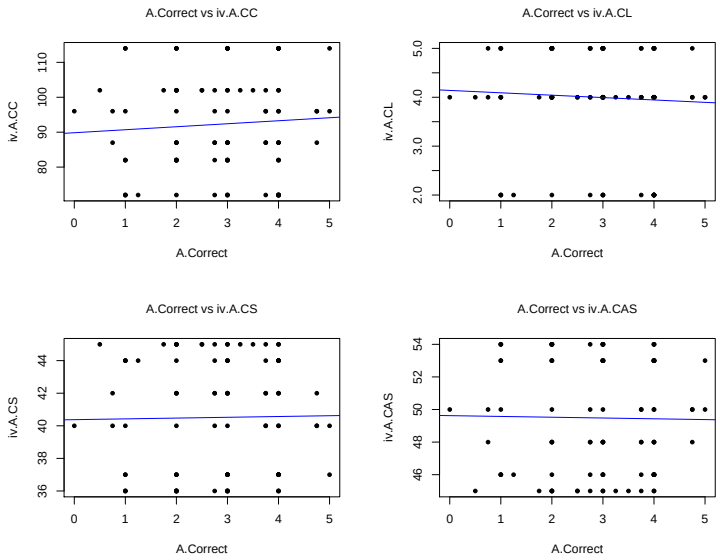


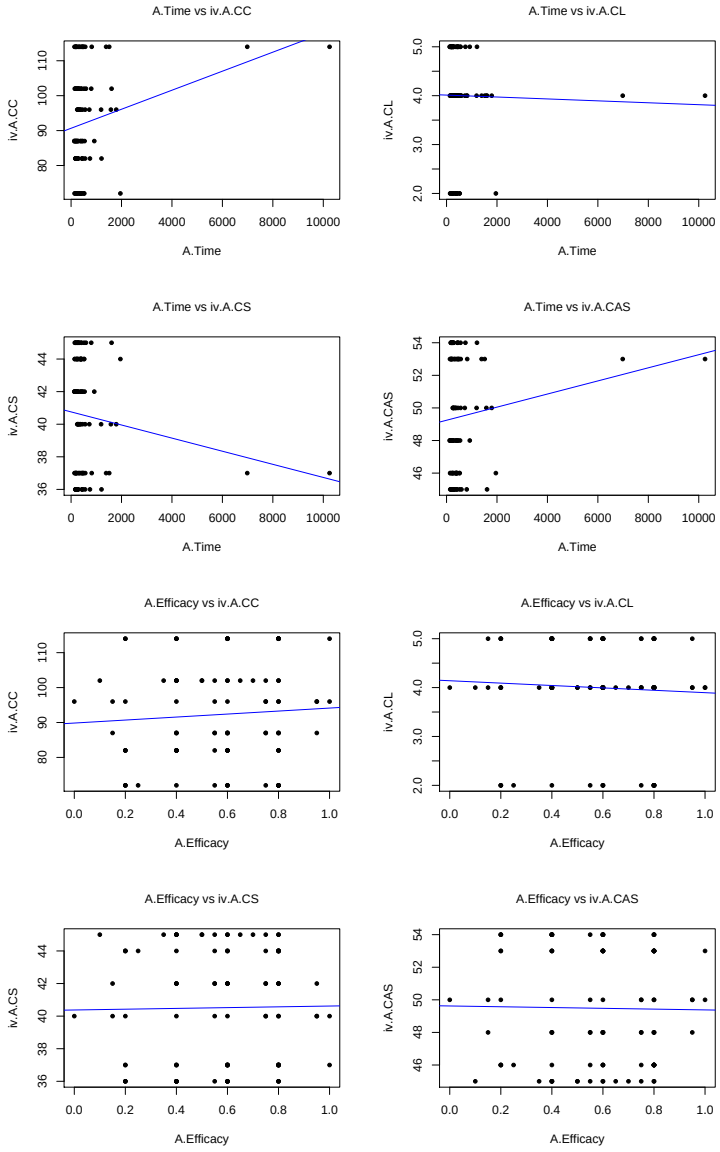


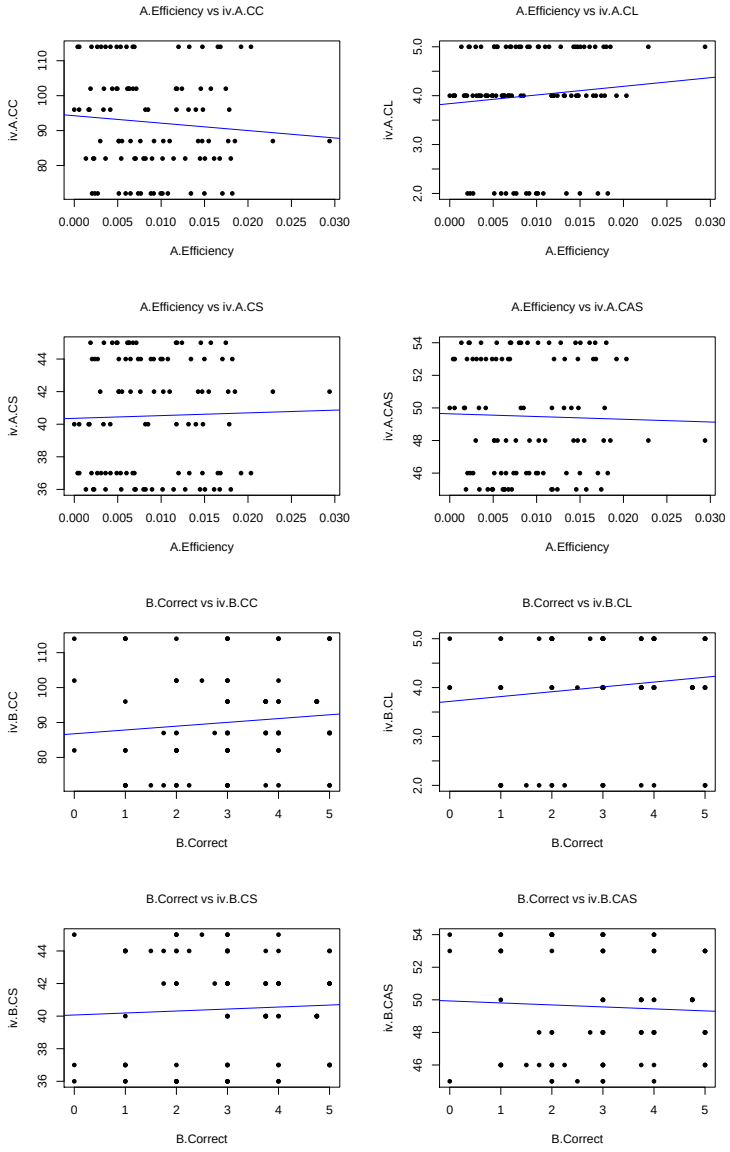
4.3 Scatter-Plots

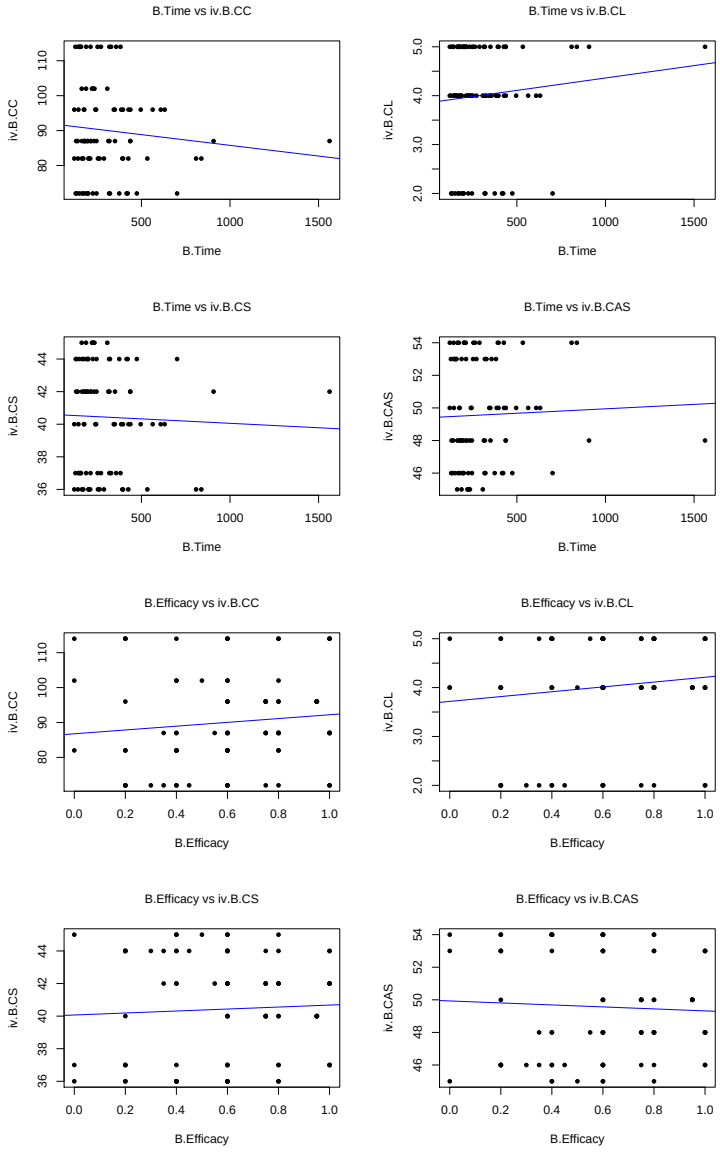
A series of scatter-plots were constructed between these measures in order to explore the presence of linearity. Observations are represented with a dot. A blue regression line is plotted on all the scatter-plots. For scatter-plots with ordinal data, a red 'x' represents the mean on each column, and a red line connecting the means is also plotted.

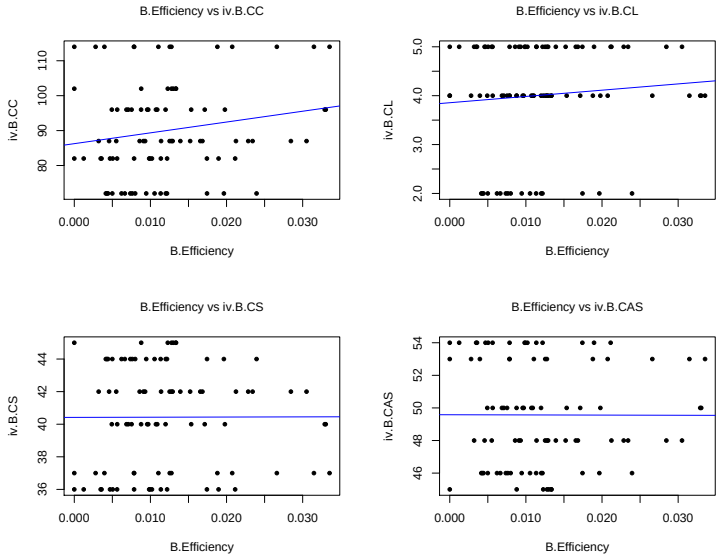
4.3.1 Model Comprehension Scatter-Plots



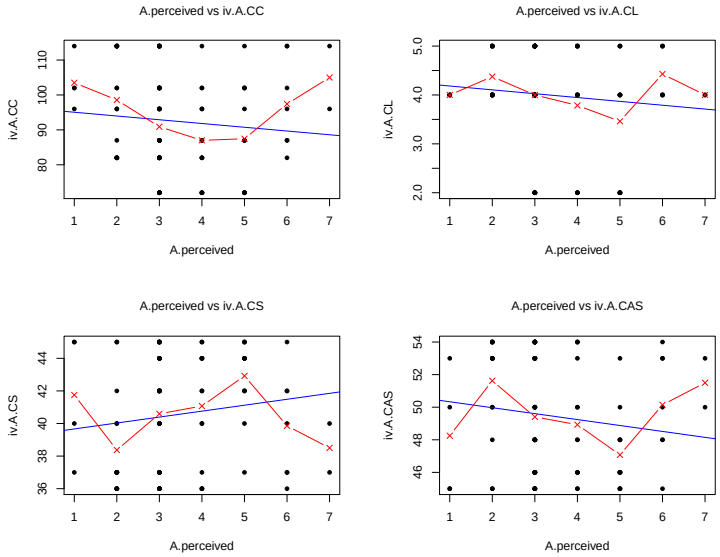

A.Time vs iv.A.CC
iv.A.CC
A.Time
A.Time vs iv.A.CL
iv.A.CL
A.Time
A.Time vs iv.A.CS
iv.A.CS
A.Time
A.Time vs iv.A.CAS
iv.A.CAS
A.Time
A.Efficacy vs iv.A.CC
iv.A.CC
A.Efficacy
A.Efficacy vs iv.A.CL
iv.A.CL
A.Efficacy
A.Efficacy vs iv.A.CS
iv.A.CS
A.Efficacy
A.Efficacy vs iv.A.CAS
iv.A.CAS
A.Efficacy

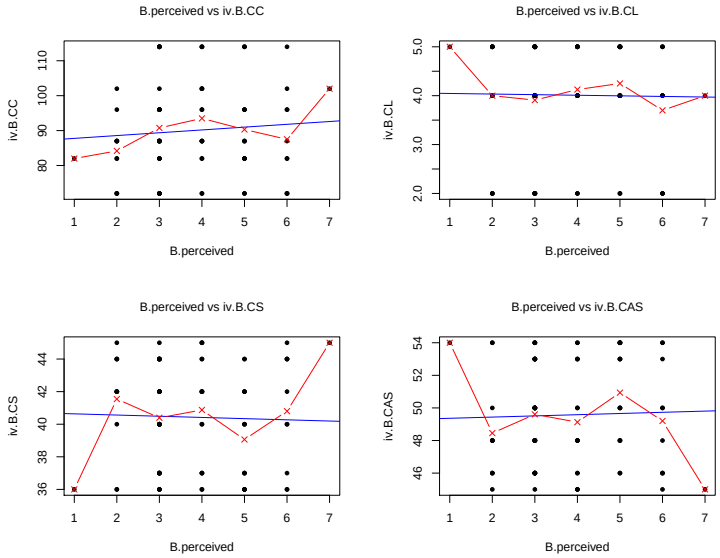

A.Efficiency vs iv.A.CC
iv.A.CC
A.Efficiency
A.Efficiency vs iv.A.CL
iv.A.CL
A.Efficiency
A.Efficiency vs iv.A.CS
iv.A.CS
A.Efficiency
A.Efficiency vs iv.A.CAS
iv.A.CAS
A.Efficiency
B.Correct vs iv.B.CC
iv.B.CC
B.Correct
B.Correct vs iv.B.CL
iv.B.CL
B.Correct
B.Correct vs iv.B.CS
iv.B.CS
B.Correct
B.Correct vs iv.B.CAS
iv.B.CAS
B.Correct


B.Time vs iv.B.CC
iv.B.CC
B.Time
B.Time vs iv.B.CL
iv.B.CL
B.Time
B.Time vs iv.B.CS
iv.B.CS
B.Time
B.Time vs iv.B.CAS
iv.B.CAS
B.Time
B.Efficacy vs iv.B.CC
iv.B.CC
B.Efficacy
B.Efficacy vs iv.B.CL
iv.B.CL
B.Efficacy
B.Efficacy vs iv.B.CS
iv.B.CS
B.Efficacy
B.Efficacy vs iv.B.CAS
iv.B.CAS
B.Efficacy

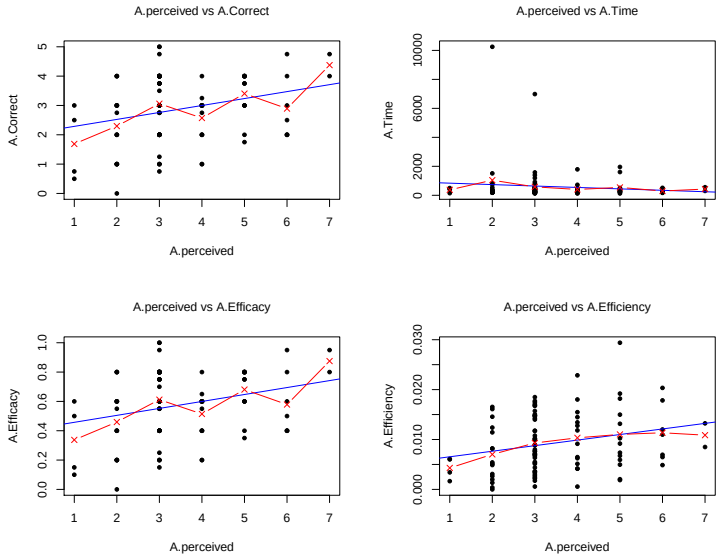


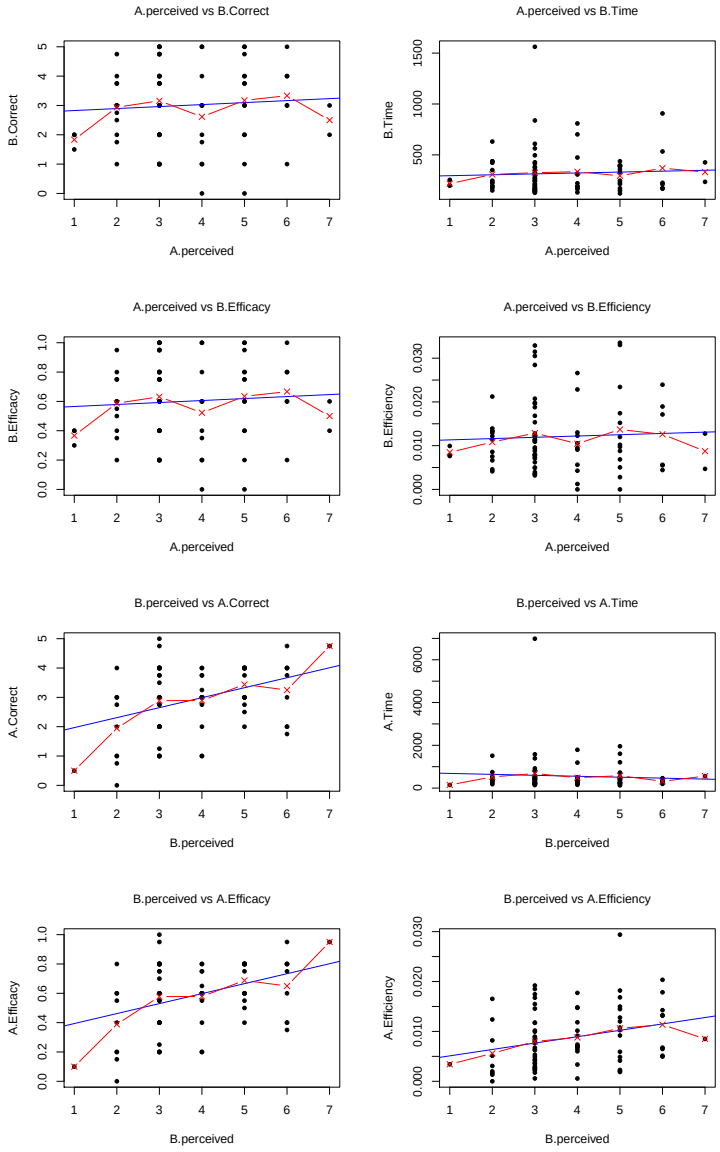
4.3.2 Perceived Complexity Scatter-Plots

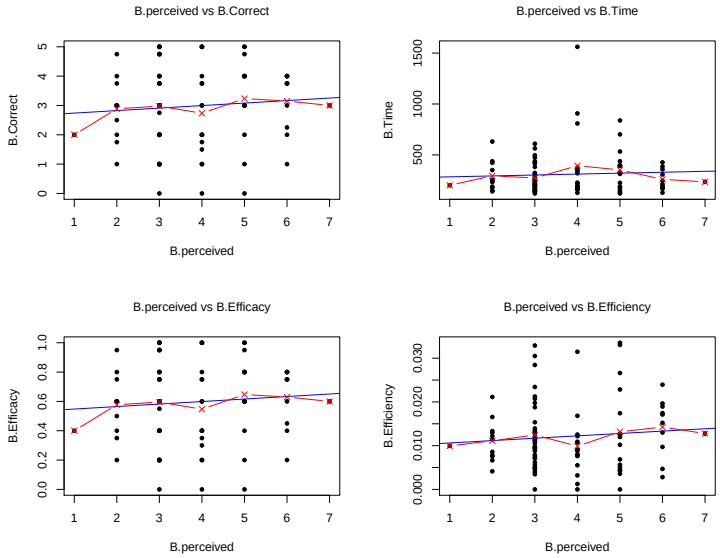




4.3.3 Perceived Complexity and Model Comprehension Scatter-Plots




A.perceived vs B.Correct
B.Correct
A.perceived
A.perceived vs B.Time
B.Time
A.perceived
A.perceived vs B.Efficacy
B.Efficacy
A.perceived
A.perceived vs B.Efficiency
B.Efficiency
A.perceived
B.perceived vs A.Correct
A.Correct
B.perceived
B.perceived vs A.Time
A.Time
B.perceived
B.perceived vs A.Efficacy
A.Efficacy
B.perceived
B.perceived vs A.Efficiency
A.Efficiency
B.perceived

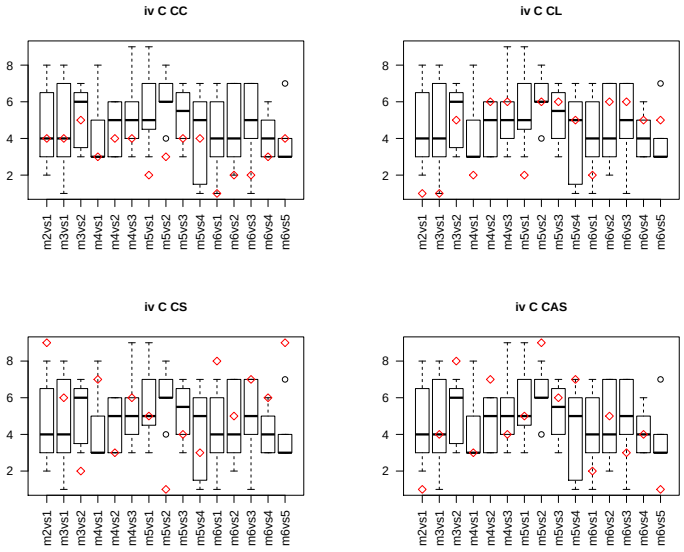


4.4 Pairwise Plots

This section presents a set of box-plots and frequency plots used to explore the data.

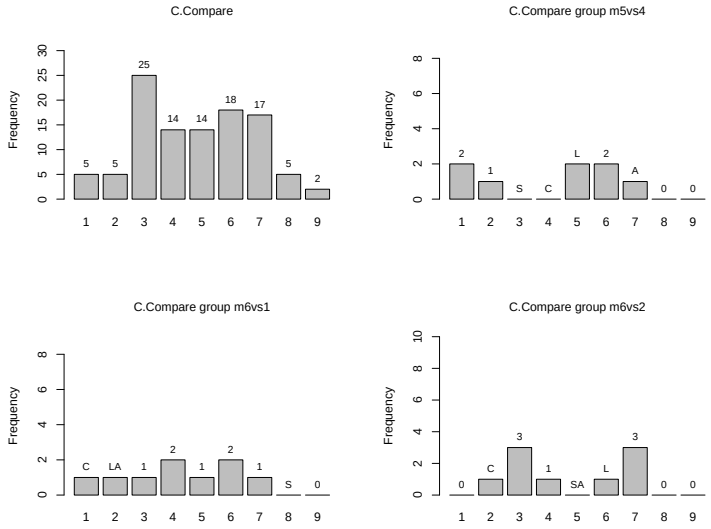
4.4.1 Pairwise Box-Plots

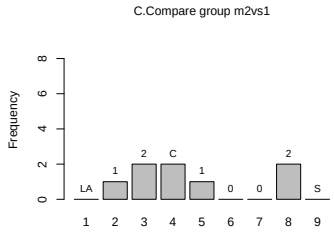
The following box-plots explore describe the C.Compare dependent variable by visualizing each independent variable order of the 15 groups. The red chevron indicates the expected mean (based on the metric ordering).

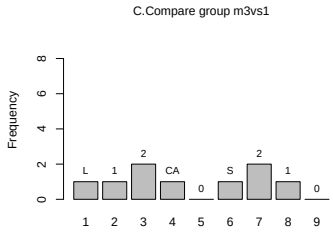


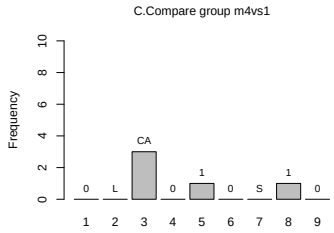
4.4.2 Pairwise Frequency Plots

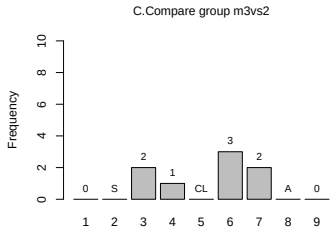
This section shows the 15 frequency plots of C.Compare categorized by each of the 15 groups (iv.C.Calc) of model comparisons. The plots have been annotated with the expected value of the independent variables as follows, `C` for CC, `L` for CL, `S` for CS, and `A` for CAS.

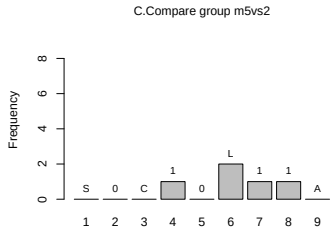


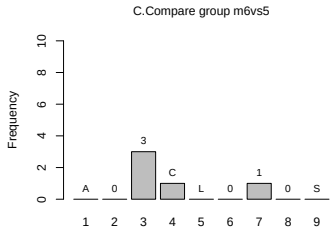

C.Compare group m2vs1
Frequency
0 2 4 6 8
LA 1 2 C 1 0 0 2 S
1 2 3 4 5 6 7 8 9

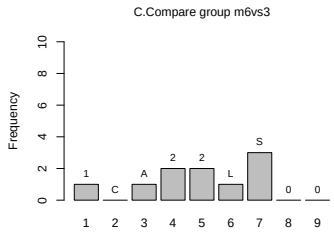

C.Compare group m3vs1
Frequency
0 2 4 6 8
L 1 2 CA 0 S 2 1 0
1 2 3 4 5 6 7 8 9

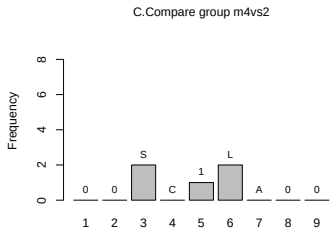

C.Compare group m4vs1
Frequency
0 2 4 6 8 10
0 L CA 0 1 0 S 1 0
1 2 3 4 5 6 7 8 9

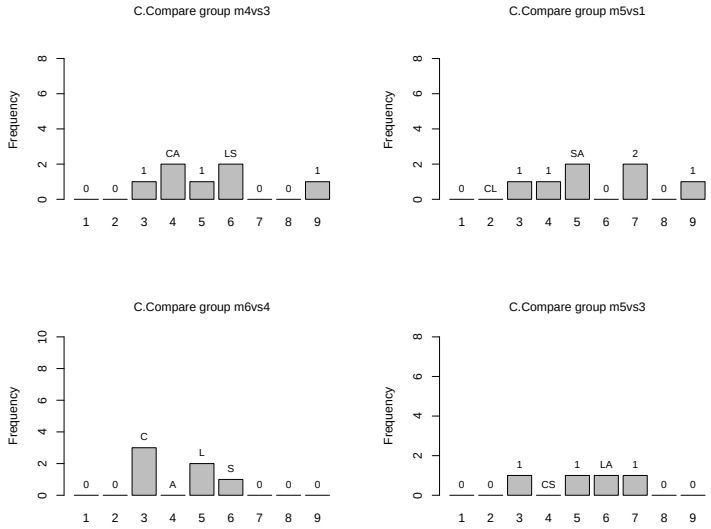

C.Compare group m3vs2
Frequency
0 2 4 6 8 10
0 S 2 1 CL 3 2 A 0
1 2 3 4 5 6 7 8 9


C.Compare group m5vs2
Frequency
0 2 4 6 8
S 0 C 1 0 L 1 1 A
1 2 3 4 5 6 7 8 9


C.Compare group m6vs5
Frequency
0 2 4 6 8 10
A 0 3 C L 0 1 0 S
1 2 3 4 5 6 7 8 9

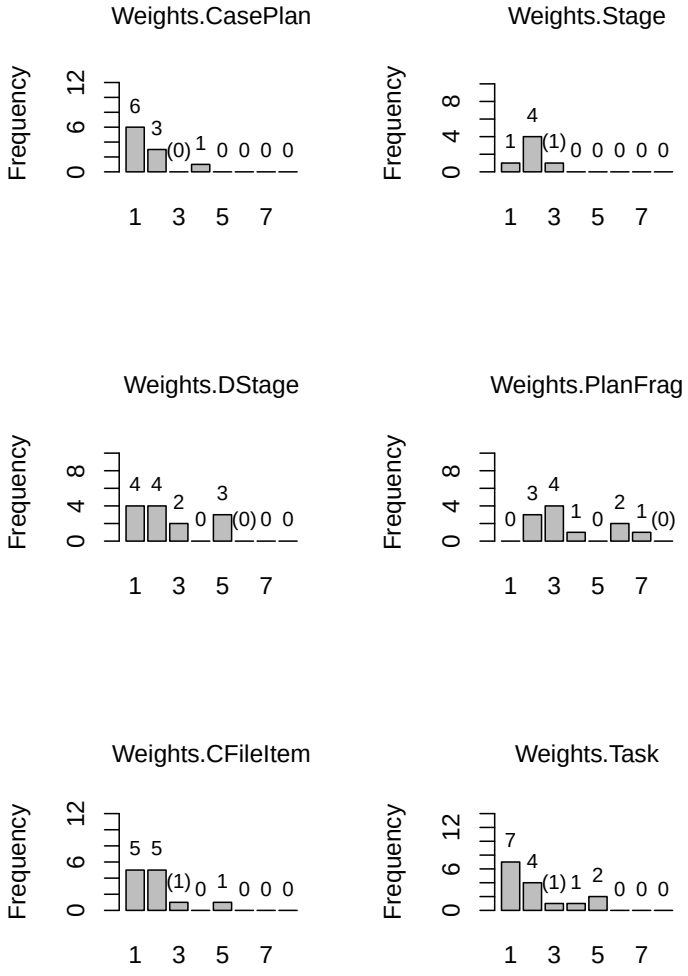

C.Compare group m6vs3
Frequency
0 2 4 6 8 10
1 C A 2 2 L S 0 0
1 2 3 4 5 6 7 8 9

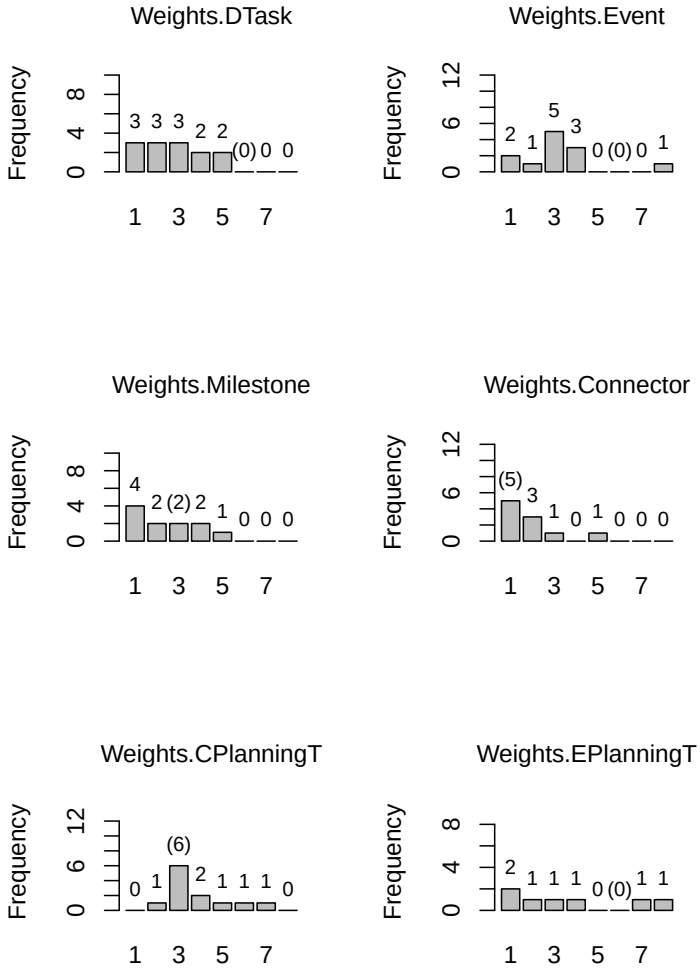

C.Compare group m4vs2
Frequency
0 2 4 6 8
0 0 S C 1 L A 0 0
1 2 3 4 5 6 7 8 9

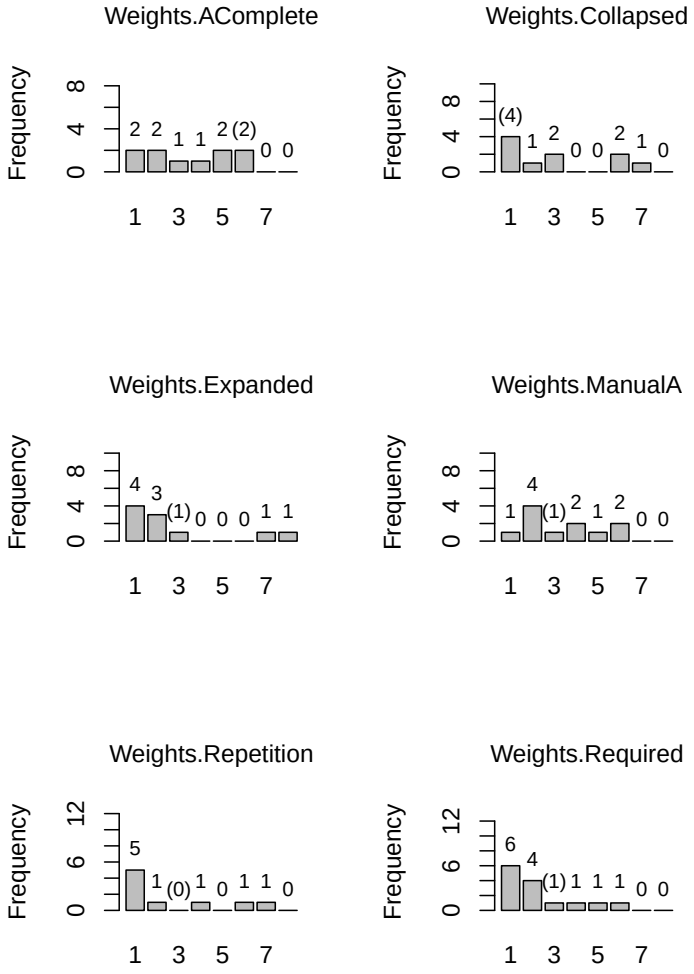


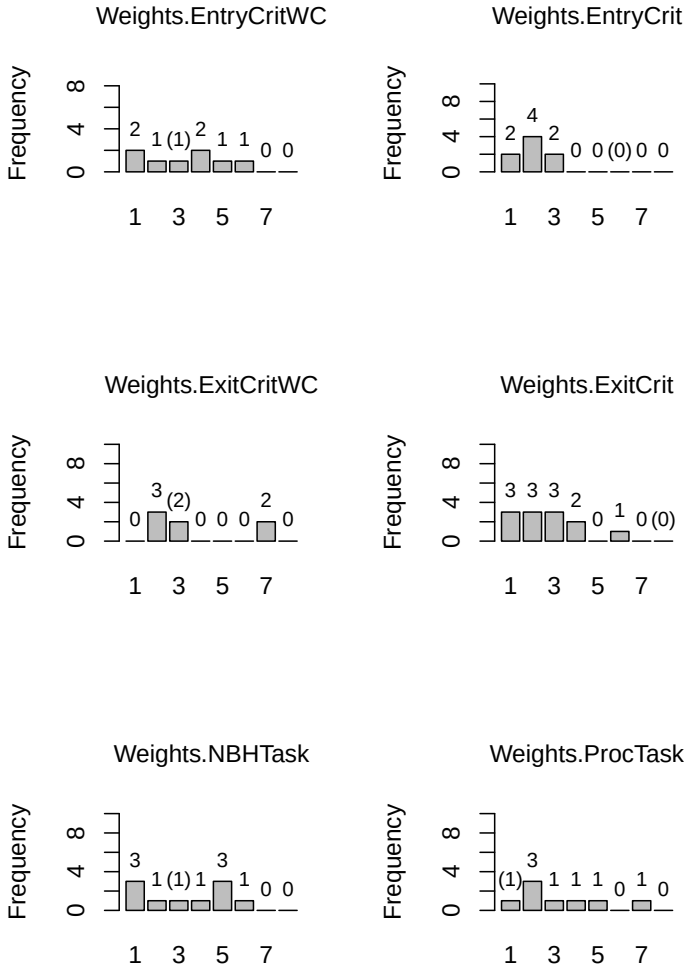
4.4.3 Complexity Weights Plots

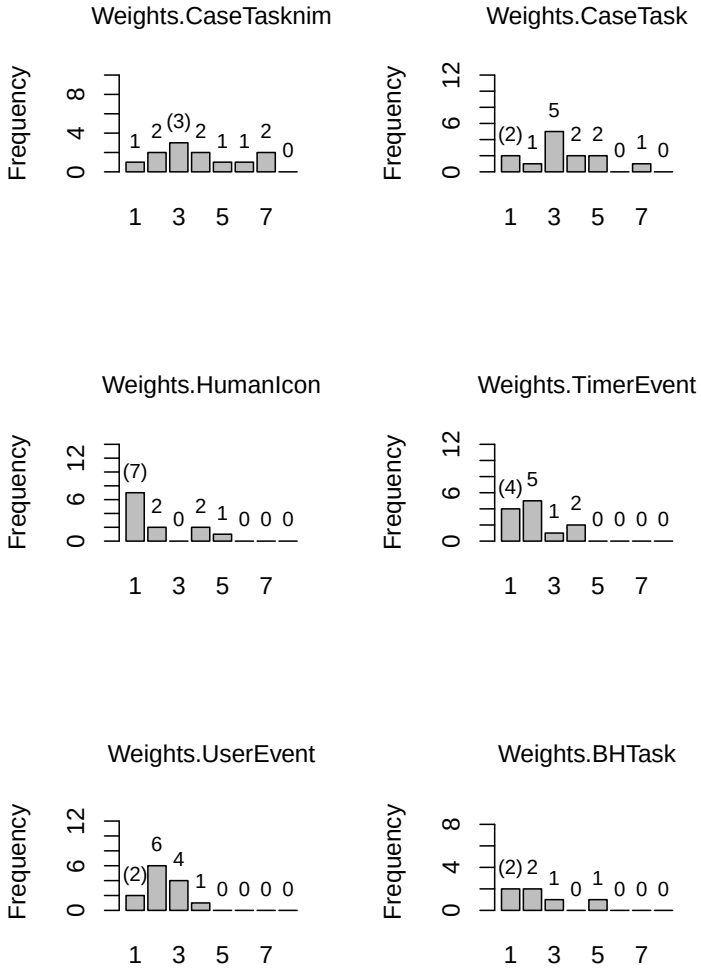
This section shows the frequency plots for the 34 weight dependent variables. Each frequency plot, shows in round parenthesis the hypothesized population mean.

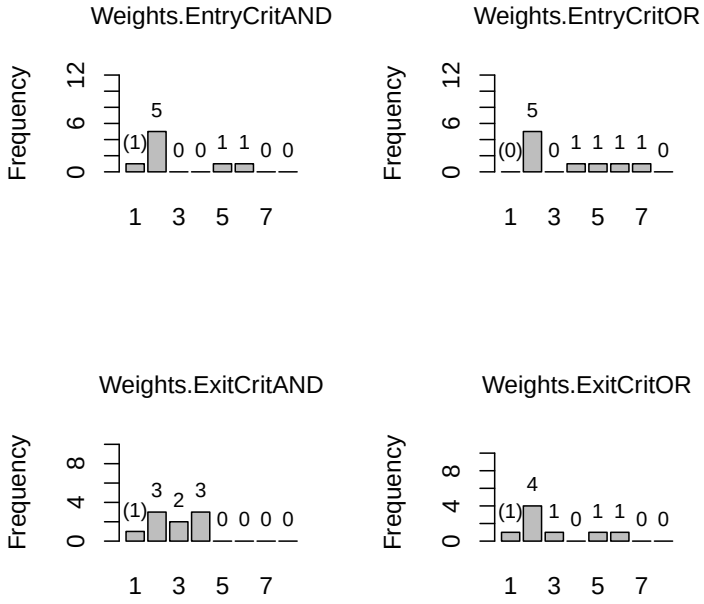

Weights.CasePlan
Frequency
0 6 12
6 3 (0) 1 0 0 0 0
1 3 5 7
Weights.Stage
Frequency
0 4 8
1 4 (1) 0 0 0 0 0
1 3 5 7
Weights.DStage
Frequency
0 4 8
4 4 2 0 3 (0) 0 0
1 3 5 7
Weights.PlanFrag
Frequency
0 4 8
0 3 4 1 0 2 1 (0)
1 3 5 7
Weights.CFileItem
Frequency
0 6 12
5 5 (1) 0 1 0 0 0
1 3 5 7
Weights.Task
Frequency
0 6 12
7 4 (1) 1 2 0 0 0
1 3 5 7


Weights.DTask
Frequency
0 4 8
3 3 3 2 2 (0) 0 0
1 3 5 7
Weights.Event
Frequency
0 6 12
2 1 5 3 0 (0) 0 1
1 3 5 7
Weights.Milestone
Frequency
0 4 8
4 2 (2) 2 1 0 0 0
1 3 5 7
Weights.Connector
Frequency
0 6 12
(5) 3 1 0 1 0 0 0
1 3 5 7
Weights.CPlanningT
Frequency
0 6 12
0 1 (6) 2 1 1 1 0
1 3 5 7
Weights.EPlanningT
Frequency
0 4 8
2 1 1 1 0 (0) 1 1
1 3 5 7


Weights.AComplete
Frequency
0 4 8
2 2 1 1 2 (2) 0 0
1 3 5 7
Weights.Collapsed
Frequency
0 4 8
(4) 1 2 0 0 2 1 0
1 3 5 7
Weights.Expanded
Frequency
0 4 8
4 3 (1) 0 0 0 1 1
1 3 5 7
Weights.ManualA
Frequency
0 4 8
1 4 (1) 2 1 2 0 0
1 3 5 7
Weights.Repetition
Frequency
0 6 12
5 1 (0) 1 0 1 1 0
1 3 5 7
Weights.Required
Frequency
0 6 12
6 4 (1) 1 1 1 0 0
1 3 5 7


Weights.EntryCritWC
Frequency
0 4 8
2 1 (1) 2 1 1 0 0
1 3 5 7
Weights.EntryCrit
Frequency
0 4 8
2 4 2 0 0 (0) 0 0
1 3 5 7
Weights.ExitCritWC
Frequency
0 4 8
0 3 (2) 0 0 0 2 0
1 3 5 7
Weights.ExitCrit
Frequency
0 4 8
3 3 3 2 0 1 0 (0)
1 3 5 7
Weights.NBHTask
Frequency
0 4 8
3 1 (1) 1 3 1 0 0
1 3 5 7
Weights.ProcTask
Frequency
0 4 8
(1) 3 1 1 1 0 1 0
1 3 5 7


Weights.CaseTasknim
Frequency
0 4 8
1 2 (3) 2 1 1 2 0
1 3 5 7
Weights.CaseTask
Frequency
0 6 12
(2) 1 5 2 2 0 1 0
1 3 5 7
Weights.HumanIcon
Frequency
0 6 12
(7) 2 0 2 1 0 0 0
1 3 5 7
Weights.TimerEvent
Frequency
0 6 12
(4) 5 1 2 0 0 0 0
1 3 5 7
Weights.UserEvent
Frequency
0 6 12
(2) 6 4 1 0 0 0 0 0
1 3 5 7
Weights.BHTask
Frequency
0 4 8
(2) 2 1 0 1 0 0 0
1 3 5 7


Weights.EntryCritAND
Frequency
0 6 12
(1) 5 0 0 1 1 0 0
1 3 5 7
Weights.EntryCritOR
Frequency
0 6 12
(0) 5 0 1 1 1 1 0
1 3 5 7
Weights.ExitCritAND
Frequency
0 4 8
(1) 3 2 3 0 0 0 0
1 3 5 7
Weights.ExitCritOR
Frequency
0 4 8
(1) 4 1 0 1 1 0 0
1 3 5 7