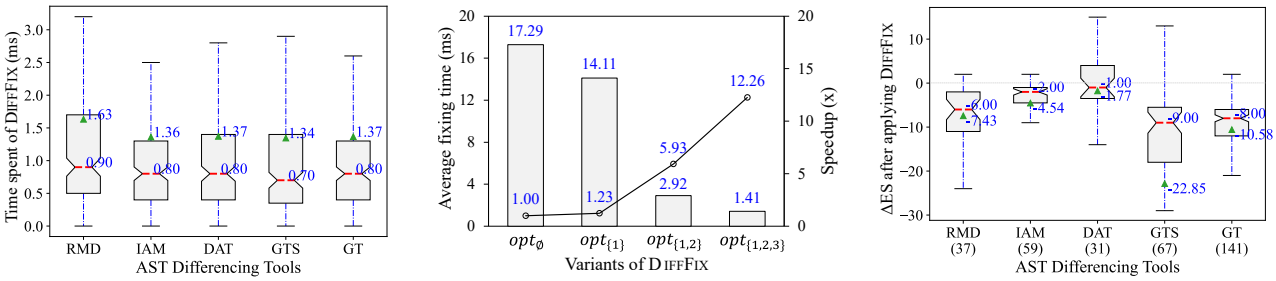
Supplementary Materials of DIFFFIX

I. EXPERIMENTAL RESULTS ON REFORACLE

On refOracle, DIFFFIX improves accuracy for all five ASTDiff techniques, while still maintaining low overhead. In addition, DIFFFIX reduces edit script size for all five techniques. The overall trend of the results on RefOracle is similar to that of Defects4j, which also illustrates the superiority of DIFFFIX in terms of accuracy and efficiency.

TABLE I: The Effect of DIFFFIX on ASTDiff Techniques.

	PDR_{stmt} (%)	PDR_{token} (%)	Missing Mappings (#)	Arbitrary Mappings (#)	Wrong Mappings (#)	T_{diff} (ms)	ES Size (#)
RMD	82.89	69.52	343	136	121	66,285.7	48,910
RMD+DIFFFIX	88.77 (+5.88)	77.01 (+7.49)	220 (–123)	170 (+34)	111 (–10)	66,590.9 (↑0.46%)	48,635 (↓0.56%)
IAM	45.45	21.93	19,706	539	1,800	160,437.8	60,059
IAM+DIFFFIX	47.59 (+2.14)	25.67 (+3.74)	19,606 (–100)	551 (+12)	1,827 (+27)	160,692.1 (↑0.16%)	59,791 (↓0.45%)
DAT	16.58	10.16	19,010	1,402	6,583	49,874.4	57,323
DAT+DIFFFIX	19.79 (+3.21)	11.23 (+1.07)	19,002 (–8)	1,343 (–59)	6,442 (–141)	50,130.7 (↑0.51%)	57,268 (↓0.10%)
GTS	13.90	8.56	20,390	461	6,424	1,369.7	62,375
GTS+DIFFFIX	20.86 (+6.95)	10.70 (+2.14)	19,738 (–652)	502 (+41)	6,317 (–107)	1,621.2 (↑18.36%)	60,844 (↓2.45%)
GT	14.97	4.81	20,789	721	6,490	133,971.4	62,848
GT+DIFFFIX	16.58 (+1.60)	8.56 (+3.74)	20,133 (–656)	722 (+1)	6,245 (–245)	134,226.9 (↑0.19%)	61,356 (↓2.37%)



(a) The Boxplot of Time Spent of DIFFFIX (b) The effect of optimizations of DIFFFIX (c) The Boxplot of ΔES of DIFFFIX

Fig. 1: The effect of optimizations of DIFFFIX on Defects4j

TABLE II: The Impact of Subprocesses

(a) The number of diffs that subprocesses take effect on (#)

	Warm-up Phase	Fixing Passes								
		MU	FP	FC	FI	FN	MI	MN	MP	MC
RMD	**5**	13	3	3	0	2	12	7	9	6
IAM	2	3	**6**	3	4	7	**23**	1	8	31
DAT	0	3	2	19	**15**	8	1	1	7	6
GTS	0	**32**	1	20	0	**16**	11	**17**	**20**	3
GT	0	12	2	**24**	13	14	4	7	18	**163**

(b) Total time spent of subprocesses (ms)

	Warm-up Phase	Fixing Passes								
		MU	FP	FC	FI	FN	MI	MN	MP	MC
RMD	124.9	3.5	4.2	6.9	11.6	7.4	13.1	5.3	10.5	35.5
IAM	136.6	6.2	5.0	8.0	**17.3**	11.8	**18.4**	4.8	12.4	39.8
DAT	**138.2**	4.7	**6.2**	**9.1**	15.0	11.2	17.4	6.6	12.2	41.3
GTS	133.3	**10.5**	5.6	7.3	12.3	**13.9**	16.1	**8.5**	12.3	41.0
GT	133.4	8.1	5.9	8.4	13.3	13.7	15.3	6.6	**13.3**	**41.8**

II. COMPARE DIFFFIX TO MOVOPT (I.E., FOUR MAPPING OPTIMIZATIONS USED IN MTDIFF)

We do not include the comparison between DIFFFIX and MOVOPT in the main text, because the purpose of MOVOPT is different from that of identifying inaccurate mappings in our work. MOVOPT also modifies the generated diff, but its purpose is to reduce the number of edit actions.

The following tables compare their accuracy improvements on the diffs generated by five ASTDiff techniques and their time cost. It can be seen that DIFFFIX is superior to MOVOPT in improving perfect diff rate and efficiency. MOVOPT tends to match more nodes but ignores the matching constraints of nodes, thus introducing many arbitrary mappings and wrong mappings.

TABLE III: The Effectiveness of DIFFFIX on Node Mapping Accuracy. (Above: Defects4j; Below: RefOracle)

	PDR_{stmt} (%)	PDR_{token} (%)	ΔMM	ΔAM	ΔWM
MOVOPT+RMD	92.12 (+2.75)	78.38 (–7.62)	–499	+841	+189
DIFFFIX +RMD	97.62 (+8.25)	95.38 (+9.38)	–555	+0	–209
MOVOPT+IAM	90.50 (+0.12)	72.50 (+1.50)	–298	+646	+98
DIFFFIX +IAM	92.25 (+1.88)	80.75 (+9.75)	–217	+16	–36
MOVOPT+DAT	82.12 (+0.12)	68.00 (–2.62)	–12	+132	–4
DIFFFIX +DAT	86.50 (+4.50)	75.88 (+5.25)	–3	–117	–199
MOVOPT+GTS	80.12 (+7.88)	64.88 (+2.25)	–1,153	+705	+243
DIFFFIX +GTS	82.88 (+10.62)	72.25 (+9.62)	–665	+6	–205
MOVOPT+GT	79.00 (+3.75)	65.00 (+47.75)	–3,043	+338	+121
DIFFFIX +GT	82.88 (+7.62)	68.38 (+51.12)	–2,482	–80	–204
MOVOPT+RMD	70.05 (–12.83)	41.18 (–28.34)	+262	+799	+1,623
DIFFFIX +RMD	88.77 (+5.88)	77.01 (+7.49)	–123	+34	–10
MOVOPT+IAM	45.45 (EQUAL)	20.86 (–1.07)	–588	+582	+1,186
DIFFFIX +IAM	47.59 (+2.14)	25.67 (+3.74)	–100	+12	+27
MOVOPT+DAT	16.58 (EQUAL)	11.76 (+1.60)	–139	+195	+610
DIFFFIX +DAT	19.79 (+3.21)	11.23 (+1.07)	–8	–59	–141
MOVOPT+GTS	16.58 (+2.67)	9.09 (+0.53)	–1,347	+614	+1,537
DIFFFIX +GTS	20.86 (+6.95)	10.70 (+2.14)	–652	+41	–107
MOVOPT+GT	14.44 (–0.53)	8.02 (+3.21)	–1,657	+407	+1,040
DIFFFIX +GT	16.58 (+1.60)	8.56 (+3.74)	–656	+1	–245

TABLE IV: The Time Cost and Efficiency of DIFFFIX. $E_{fix} = T_{map}/T_{fix}$; $O_{fix} = T_{fix}/(T_{map} + T_{fix})$.

	T_{fix} (ms)	T_{fix}^{mean} (ms)	T_{fix}^{std} (ms)	T_{map} (ms)	E_{fix}	O_{fix}
MOVOPT+RMD	2,908.9	3.64	9.95	34,415.0	11.83x	7.79%
DIFFFIX +RMD	661.4	0.83	1.11	34,108.1	51.57x	1.90%
MOVOPT+IAM	2,478.2	3.10	9.42	98,629.7	39.80x	2.45%
DIFFFIX +IAM	589.5	0.74	0.95	96,568.5	163.81x	0.61%
MOVOPT+DAT	2,424.9	3.03	9.44	32,163.6	13.26x	7.01%
DIFFFIX +DAT	565.5	0.71	0.94	32,472.9	57.42x	1.71%
MOVOPT+GTS	3,265.2	4.08	18.38	2,211.8	0.68x	59.62%
DIFFFIX +GTS	550.8	0.69	0.94	2,206.3	4.01x	19.98%
MOVOPT+GT	161,669.2	202.09	446.37	369,822.4	2.29x	30.42%
DIFFFIX +GT	582.5	0.73	0.95	370,413.4	635.90x	0.16%
MOVOPT+RMD	6,465.2	34.57	154.30	66,882.4	10.34x	8.81%
DIFFFIX +RMD	305.2	1.63	3.23	66,285.7	217.19x	0.46%
MOVOPT+IAM	5,269.3	28.18	142.03	167,768.9	31.84x	3.05%
DIFFFIX +IAM	254.3	1.36	2.30	160,437.8	630.90x	0.16%
MOVOPT+DAT	7,576.2	40.51	216.49	49,551.7	6.54x	13.26%
DIFFFIX +DAT	256.3	1.37	2.44	49,874.4	194.59x	0.51%
MOVOPT+GTS	8,141.6	43.54	220.99	1,381.6	0.17x	85.49%
DIFFFIX +GTS	251.5	1.34	2.36	1,369.7	5.45x	15.51%
MOVOPT+GT	88,607.4	473.84	1,860.92	133,795.2	1.51x	39.84%
DIFFFIX +GT	255.5	1.37	2.26	133,971.4	524.35x	0.19%