

Appendix for submission “Exploring Time Granularity on Temporal Graphs for Dynamic Link Prediction in Real-world Networks”

A Reproducibility

A.1 Real-word Datasets

Table A.1: Datasets Statistics with associated semantic meanings.

Dataset	Domain	Node	# Nodes	Edge	Total Edges	Unique Edges	Unique Steps	Duration
Wikipedia [19]	Social	Editors & Wiki Pages	9,227	Editing Request	157,474	18,257	152,757	1 Month
Reddit [19]	Social	Users & Posts	10,984	Posting Request	672,447	78,516	588,918	1 Month
MOOC [19]	Interaction	Students & Online Courses	7,144	Accessing a online course	411,749	178,443	345,600	1 Month
LastFM [19]	Interaction	Users & Songs	1,980	Listening a song	1,293,103	154,993	1,283,614	4 Years
Enron [45]	Social	Employees	184	Email communication	125,235	3,125	22,632	3 Years
Social Evo. [46]	Proximity	Students	74	Cellphone calls	2,099,519	4,486	565,932	1 Year
UCI [47]	Social	Students	1,899	Online Chats	59,835	20,296	58,911	196 Days

A.2 Data Distribution

Table A.2: Data distribution in a 0.7-0.15-0.15 chronological split for different time granularities.

Granularity	Wikipedia			Reddit			MOOC		
	Train	Val	Test	Train	Val	Test	Train	Val	Test
Second	110,232	23,621	23,621	470,713	100,667	100,867	288,224	61,762	61,763
Minute	110,237	23,620	23,617	470,722	100,858	100,867	288,224	61,770	61,755
Hour	110,368	23,754	23,352	470,815	101,296	100,336	288,480	62,271	60,998
Day	112,937	22,904	21,633	475,299	114,325	82,823	301,509	62,868	47,372
Month	153,823	0	3,651	650,442	0	22,005	411,749	0	0
Year	157,474	0	0	672,447	0	0	411,749	0	0

Granularity	LastFM			Enron			Social Evo.			UCI		
	Train	Val	Test	Train	Val	Test	Train	Val	Test	Train	Val	Test
Second	905,172	193,965	193,966	87,664	18,786	18,785	1,469,665	314,930	314,924	41,884	8,975	8,976
Minute	905,174	193,963	193,966	87,664	18,786	18,785	1,469,671	314,924	314,924	41,885	8,974	8,976
Hour	905,232	193,919	193,952	87,665	18,808	18,762	1,470,682	314,396	314,441	41,895	8,964	8,976
Day	905,232	194,399	193,472	87,743	18,971	18,521	1,474,123	317,858	307,538	42,079	8,790	8,966
Month	936,951	182,053	174,099	89,523	24,162	11,550	1,668,041	424,508	6,970	49,409	3,323	7,103
Year	1,159,991	0	133,112	105,631	19,604	0	2,099,519	0	0	59,835	0	0

A.3 Hyperparameters in Model Training

Table A.3: Training Configuration & Hyperparameter Setting for Experiments.

Hyperparameter	Value
Learning Rate	0.0001
Optimizer	Adam
Batch Size	200
Number of Epoches	20
Tolerance for Early Stopping	5 Epoches
Dropout Rate	0.1
Attention Heads	2
Node Embeddings	100
Time Embeddings	100
Memory Dimension (TGN)	172
Message Dimension (TGN)	100
Number of Runs	3

7 B Numerical Results of Cross-granularity Evaluation

Table B.4: AU-ROC of dynamic link prediction on the "second" granularity data across three negative sampling strategies. Note that we report the mean AU-ROC over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.992 (0.001)	0.999 (0.000)	0.857 (0.015)	0.999 (0.000)	0.930 (0.005)	0.996 (0.000)	0.994 (0.001)	3
DyRep-s	0.681 (0.010)	0.566 (0.000)	0.606 (0.005)	0.505 (0.009)	0.643 (0.011)	0.679 (0.053)	0.833 (0.001)	12
TGN-s	0.979 (0.001)	0.961 (0.000)	0.789 (0.012)	0.694 (0.013)	0.808 (0.019)	0.923 (0.001)	0.901 (0.006)	6
JODIE-m	0.993 (0.000)	0.999 (0.000)	0.865 (0.007)	0.999 (0.000)	0.926 (0.002)	0.995 (0.001)	0.995 (0.000)	1
DyRep-m	0.677 (0.011)	0.561 (0.000)	0.588 (0.010)	0.495 (0.005)	0.634 (0.019)	0.696 (0.015)	0.837 (0.008)	13
TGN-m	0.978 (0.001)	0.955 (0.000)	0.805 (0.029)	0.695 (0.016)	0.807 (0.020)	0.869 (0.007)	0.903 (0.039)	5
JODIE-h	0.992 (0.001)	0.996 (0.000)	0.845 (0.018)	0.997 (0.000)	0.923 (0.017)	0.914 (0.000)	0.995 (0.001)	2
DyRep-h	0.640 (0.011)	0.496 (0.000)	0.590 (0.012)	0.503 (0.000)	0.593 (0.057)	0.701 (0.000)	0.829 (0.016)	14
TGN-h	0.960 (0.001)	0.928 (0.000)	0.688 (0.000)	0.684 (0.000)	0.764 (0.027)	0.562 (0.000)	0.813 (0.023)	8
JODIE-d	0.976 (0.005)	0.886 (0.000)	0.623 (0.000)	0.928 (0.000)	0.920 (0.004)	0.633 (0.000)	0.994 (0.001)	4
DyRep-d	0.582 (0.032)	0.462 (0.000)	0.591 (0.000)	0.505 (0.000)	0.649 (0.006)	0.513 (0.000)	0.835 (0.009)	11
TGN-d	0.944 (0.005)	0.923 (0.000)	0.570 (0.000)	0.602 (0.000)	0.795 (0.016)	0.595 (0.000)	0.836 (0.024)	9
EdgeBank _{tw}	0.888 (0.000)	0.924 (0.000)	0.607 (0.000)	0.840 (0.000)	0.867 (0.000)	0.600 (0.000)	0.733 (0.000)	7
EdgeBank _∞	0.911 (0.000)	0.954 (0.000)	0.548 (0.000)	0.827 (0.000)	0.858 (0.000)	0.538 (0.000)	0.749 (0.000)	10

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.360 (0.006)	0.373 (0.007)	0.147 (0.010)	0.415 (0.006)	0.443 (0.002)	0.621 (0.020)	0.431 (0.037)	11
DyRep-s	0.386 (0.003)	0.421 (0.000)	0.408 (0.008)	0.481 (0.017)	0.590 (0.018)	0.715 (0.064)	0.441 (0.016)	7
TGN-s	0.815 (0.014)	0.765 (0.000)	0.695 (0.042)	0.589 (0.008)	0.657 (0.003)	0.885 (0.009)	0.755 (0.011)	2
JODIE-m	0.364 (0.002)	0.372 (0.011)	0.138 (0.010)	0.410 (0.010)	0.445 (0.002)	0.606 (0.023)	0.386 (0.006)	12
DyRep-m	0.370 (0.014)	0.463 (0.000)	0.387 (0.003)	0.464 (0.011)	0.591 (0.011)	0.736 (0.010)	0.425 (0.031)	9
TGN-m	0.809 (0.003)	0.735 (0.000)	0.714 (0.049)	0.641 (0.031)	0.656 (0.004)	0.846 (0.044)	0.714 (0.063)	1
JODIE-h	0.360 (0.010)	0.315 (0.000)	0.119 (0.002)	0.328 (0.001)	0.444 (0.002)	0.528 (0.000)	0.383 (0.042)	14
DyRep-h	0.386 (0.008)	0.550 (0.000)	0.431 (0.034)	0.464 (0.001)	0.555 (0.046)	0.763 (0.000)	0.450 (0.031)	8
TGN-h	0.734 (0.023)	0.742 (0.000)	0.634 (0.001)	0.618 (0.001)	0.604 (0.017)	0.613 (0.000)	0.648 (0.031)	5
JODIE-d	0.403 (0.016)	0.381 (0.000)	0.223 (0.000)	0.195 (0.000)	0.441 (0.001)	0.521 (0.000)	0.339 (0.024)	13
DyRep-d	0.379 (0.001)	0.449 (0.000)	0.402 (0.000)	0.498 (0.000)	0.590 (0.011)	0.467 (0.000)	0.465 (0.017)	6
TGN-d	0.731 (0.014)	0.739 (0.000)	0.702 (0.000)	0.624 (0.000)	0.648 (0.030)	0.629 (0.000)	0.634 (0.079)	4
EdgeBank _{tw}	0.754 (0.000)	0.748 (0.000)	0.564 (0.000)	0.694 (0.000)	0.606 (0.000)	0.710 (0.000)	0.717 (0.000)	3
EdgeBank _∞	0.492 (0.000)	0.508 (0.000)	0.293 (0.000)	0.493 (0.000)	0.451 (0.000)	0.523 (0.000)	0.381 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.324 (0.004)	0.391 (0.005)	0.325 (0.030)	0.465 (0.004)	0.502 (0.001)	0.626 (0.020)	0.513 (0.020)	9
DyRep-s	0.607 (0.009)	0.448 (0.000)	0.561 (0.003)	0.505 (0.001)	0.586 (0.014)	0.712 (0.053)	0.480 (0.018)	6
TGN-s	0.803 (0.008)	0.802 (0.000)	0.654 (0.029)	0.557 (0.005)	0.691 (0.009)	0.880 (0.010)	0.746 (0.024)	1
JODIE-m	0.323 (0.002)	0.390 (0.008)	0.308 (0.026)	0.463 (0.006)	0.501 (0.002)	0.610 (0.025)	0.479 (0.007)	14
DyRep-m	0.584 (0.034)	0.493 (0.000)	0.521 (0.013)	0.499 (0.008)	0.583 (0.017)	0.729 (0.012)	0.471 (0.027)	8
TGN-m	0.783 (0.006)	0.790 (0.000)	0.632 (0.014)	0.597 (0.025)	0.690 (0.010)	0.837 (0.046)	0.741 (0.030)	2
JODIE-h	0.327 (0.001)	0.366 (0.000)	0.248 (0.018)	0.422 (0.001)	0.501 (0.005)	0.526 (0.000)	0.480 (0.036)	11
DyRep-h	0.590 (0.016)	0.577 (0.000)	0.546 (0.000)	0.497 (0.001)	0.561 (0.036)	0.751 (0.000)	0.490 (0.016)	7
TGN-h	0.701 (0.010)	0.743 (0.000)	0.518 (0.000)	0.543 (0.001)	0.657 (0.014)	0.593 (0.000)	0.648 (0.009)	3
JODIE-d	0.442 (0.013)	0.460 (0.000)	0.458 (0.000)	0.339 (0.000)	0.496 (0.001)	0.515 (0.000)	0.455 (0.011)	12
DyRep-d	0.576 (0.027)	0.438 (0.000)	0.534 (0.000)	0.514 (0.000)	0.593 (0.011)	0.468 (0.000)	0.507 (0.014)	5
TGN-d	0.706 (0.011)	0.724 (0.000)	0.468 (0.000)	0.527 (0.000)	0.672 (0.017)	0.602 (0.000)	0.642 (0.019)	4
EdgeBank _{tw}	0.417 (0.000)	0.439 (0.000)	0.189 (0.000)	0.447 (0.000)	0.484 (0.000)	0.677 (0.000)	0.491 (0.000)	13
EdgeBank _∞	0.435 (0.000)	0.465 (0.000)	0.219 (0.000)	0.463 (0.000)	0.468 (0.000)	0.566 (0.000)	0.515 (0.000)	10

Table B.5: AU-ROC of dynamic link prediction on the "minute" granularity data across three negative sampling strategies. Note that we report the mean AU-ROC over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.992 (0.001)	0.999 (0.000)	0.856 (0.015)	0.999 (0.000)	0.930 (0.005)	0.996 (0.000)	0.994 (0.001)	2
DyRep-s	0.679 (0.009)	0.568 (0.000)	0.603 (0.007)	0.508 (0.008)	0.634 (0.015)	0.678 (0.055)	0.830 (0.002)	11
TGN-s	0.977 (0.001)	0.961 (0.000)	0.752 (0.026)	0.694 (0.013)	0.809 (0.017)	0.847 (0.004)	0.893 (0.009)	5
JODIE-m	0.993 (0.000)	0.999 (0.000)	0.864 (0.007)	0.999 (0.000)	0.927 (0.002)	0.995 (0.001)	0.995 (0.000)	1
DyRep-m	0.676 (0.010)	0.559 (0.000)	0.587 (0.008)	0.499 (0.004)	0.629 (0.009)	0.697 (0.016)	0.837 (0.010)	12
TGN-m	0.977 (0.001)	0.955 (0.000)	0.802 (0.027)	0.695 (0.015)	0.810 (0.017)	0.875 (0.007)	0.892 (0.034)	4
JODIE-h	0.992 (0.001)	0.996 (0.000)	0.844 (0.020)	0.997 (0.000)	0.923 (0.016)	0.909 (0.000)	0.995 (0.001)	3
DyRep-h	0.639 (0.012)	0.498 (0.000)	0.592 (0.014)	0.501 (0.000)	0.590 (0.058)	0.692 (0.000)	0.829 (0.017)	13
TGN-h	0.960 (0.001)	0.929 (0.000)	0.688 (0.000)	0.683 (0.000)	0.764 (0.027)	0.601 (0.000)	0.811 (0.022)	7
JODIE-d	0.976 (0.005)	0.884 (0.000)	0.629 (0.000)	0.930 (0.000)	0.921 (0.002)	0.633 (0.000)	0.994 (0.001)	6
DyRep-d	0.585 (0.032)	0.464 (0.000)	0.595 (0.000)	0.498 (0.000)	0.637 (0.013)	0.513 (0.000)	0.834 (0.009)	14
TGN-d	0.944 (0.005)	0.922 (0.000)	0.570 (0.000)	0.602 (0.000)	0.795 (0.015)	0.595 (0.000)	0.836 (0.023)	10
EdgeBank _{tw}	0.888 (0.000)	0.924 (0.000)	0.607 (0.000)	0.840 (0.000)	0.867 (0.000)	0.600 (0.000)	0.733 (0.000)	8
EdgeBank _∞	0.911 (0.000)	0.954 (0.000)	0.548 (0.000)	0.827 (0.000)	0.858 (0.000)	0.538 (0.000)	0.749 (0.000)	9

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.363 (0.007)	0.373 (0.007)	0.148 (0.011)	0.415 (0.006)	0.442 (0.001)	0.620 (0.021)	0.431 (0.036)	11
DyRep-s	0.385 (0.005)	0.423 (0.000)	0.404 (0.010)	0.480 (0.019)	0.576 (0.024)	0.714 (0.065)	0.441 (0.017)	7
TGN-s	0.808 (0.015)	0.763 (0.000)	0.685 (0.043)	0.589 (0.007)	0.661 (0.001)	0.845 (0.013)	0.745 (0.013)	1
JODIE-m	0.366 (0.003)	0.372 (0.011)	0.139 (0.010)	0.410 (0.011)	0.443 (0.002)	0.603 (0.022)	0.386 (0.006)	12
DyRep-m	0.367 (0.012)	0.455 (0.000)	0.387 (0.003)	0.454 (0.007)	0.584 (0.011)	0.734 (0.015)	0.423 (0.032)	8
TGN-m	0.805 (0.002)	0.732 (0.000)	0.704 (0.052)	0.640 (0.030)	0.661 (0.002)	0.883 (0.021)	0.696 (0.062)	2
JODIE-h	0.362 (0.011)	0.316 (0.001)	0.119 (0.002)	0.327 (0.001)	0.443 (0.002)	0.526 (0.000)	0.384 (0.041)	14
DyRep-h	0.384 (0.011)	0.548 (0.000)	0.429 (0.033)	0.466 (0.001)	0.565 (0.050)	0.754 (0.000)	0.450 (0.032)	6
TGN-h	0.736 (0.022)	0.745 (0.000)	0.623 (0.001)	0.614 (0.002)	0.603 (0.017)	0.664 (0.000)	0.644 (0.028)	5
JODIE-d	0.404 (0.016)	0.381 (0.001)	0.220 (0.000)	0.197 (0.000)	0.441 (0.001)	0.521 (0.000)	0.339 (0.024)	13
DyRep-d	0.377 (0.003)	0.454 (0.000)	0.410 (0.000)	0.498 (0.000)	0.580 (0.015)	0.467 (0.000)	0.463 (0.018)	9
TGN-d	0.731 (0.016)	0.739 (0.000)	0.700 (0.000)	0.625 (0.000)	0.647 (0.031)	0.629 (0.000)	0.634 (0.078)	4
EdgeBank _{tw}	0.754 (0.000)	0.748 (0.000)	0.570 (0.000)	0.700 (0.000)	0.606 (0.000)	0.710 (0.000)	0.717 (0.000)	3
EdgeBank _∞	0.492 (0.000)	0.508 (0.000)	0.293 (0.000)	0.493 (0.000)	0.451 (0.000)	0.523 (0.000)	0.381 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.324 (0.004)	0.391 (0.005)	0.326 (0.030)	0.466 (0.004)	0.501 (0.001)	0.627 (0.021)	0.512 (0.020)	9
DyRep-s	0.608 (0.008)	0.450 (0.000)	0.556 (0.005)	0.510 (0.014)	0.577 (0.017)	0.712 (0.054)	0.479 (0.020)	6
TGN-s	0.795 (0.009)	0.801 (0.000)	0.631 (0.012)	0.557 (0.005)	0.695 (0.007)	0.837 (0.013)	0.734 (0.025)	1
JODIE-m	0.323 (0.002)	0.390 (0.008)	0.308 (0.027)	0.463 (0.006)	0.500 (0.002)	0.609 (0.025)	0.479 (0.007)	12
DyRep-m	0.583 (0.034)	0.485 (0.000)	0.520 (0.012)	0.485 (0.006)	0.577 (0.014)	0.727 (0.016)	0.470 (0.028)	7
TGN-m	0.779 (0.004)	0.789 (0.000)	0.622 (0.013)	0.596 (0.024)	0.694 (0.007)	0.875 (0.022)	0.722 (0.030)	2
JODIE-h	0.328 (0.001)	0.366 (0.000)	0.249 (0.018)	0.422 (0.001)	0.501 (0.004)	0.525 (0.000)	0.480 (0.035)	14
DyRep-h	0.589 (0.014)	0.575 (0.000)	0.544 (0.006)	0.485 (0.002)	0.566 (0.040)	0.741 (0.000)	0.489 (0.015)	5
TGN-h	0.702 (0.010)	0.749 (0.000)	0.514 (0.001)	0.542 (0.000)	0.656 (0.011)	0.644 (0.000)	0.643 (0.007)	3
JODIE-d	0.441 (0.014)	0.459 (0.001)	0.456 (0.000)	0.339 (0.000)	0.497 (0.001)	0.515 (0.000)	0.454 (0.011)	13
DyRep-d	0.581 (0.031)	0.445 (0.000)	0.540 (0.000)	0.516 (0.000)	0.585 (0.018)	0.468 (0.000)	0.504 (0.019)	8
TGN-d	0.705 (0.011)	0.725 (0.000)	0.461 (0.000)	0.528 (0.000)	0.673 (0.017)	0.602 (0.000)	0.642 (0.019)	4
EdgeBank _{tw}	0.417 (0.000)	0.439 (0.000)	0.189 (0.000)	0.447 (0.000)	0.484 (0.000)	0.677 (0.000)	0.491 (0.000)	11
EdgeBank _∞	0.435 (0.000)	0.465 (0.000)	0.219 (0.000)	0.463 (0.000)	0.468 (0.000)	0.566 (0.000)	0.515 (0.000)	10

Table B.6: AU-ROC of dynamic link prediction on the "hour" granularity data across three negative sampling strategies. Note that we report the mean AU-ROC over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.991 (0.001)	0.987 (0.001)	0.765 (0.012)	0.993 (0.000)	0.932 (0.005)	0.781 (0.052)	0.994 (0.001)	3
DyRep-s	0.561 (0.011)	0.483 (0.000)	0.585 (0.011)	0.504 (0.007)	0.636 (0.013)	0.679 (0.057)	0.829 (0.003)	14
TGN-s	0.949 (0.005)	0.909 (0.000)	0.616 (0.012)	0.659 (0.015)	0.802 (0.025)	0.677 (0.018)	0.854 (0.005)	6
JODIE-m	0.993 (0.001)	0.986 (0.000)	0.760 (0.002)	0.993 (0.000)	0.928 (0.003)	0.783 (0.040)	0.995 (0.000)	2
DyRep-m	0.619 (0.027)	0.531 (0.000)	0.560 (0.033)	0.503 (0.009)	0.644 (0.002)	0.687 (0.023)	0.835 (0.013)	13
TGN-m	0.953 (0.001)	0.850 (0.000)	0.618 (0.041)	0.667 (0.013)	0.802 (0.025)	0.657 (0.045)	0.848 (0.057)	7
JODIE-h	0.992 (0.001)	0.992 (0.000)	0.785 (0.009)	0.993 (0.000)	0.926 (0.015)	0.898 (0.000)	0.995 (0.001)	1
DyRep-h	0.668 (0.016)	0.659 (0.000)	0.612 (0.013)	0.510 (0.000)	0.607 (0.052)	0.699 (0.000)	0.833 (0.013)	11
TGN-h	0.956 (0.001)	0.969 (0.000)	0.708 (0.000)	0.682 (0.000)	0.770 (0.025)	0.810 (0.000)	0.839 (0.019)	5
JODIE-d	0.978 (0.004)	0.929 (0.000)	0.709 (0.000)	0.939 (0.000)	0.922 (0.006)	0.770 (0.000)	0.994 (0.001)	4
DyRep-d	0.590 (0.020)	0.539 (0.000)	0.618 (0.000)	0.504 (0.000)	0.647 (0.014)	0.482 (0.000)	0.838 (0.008)	12
TGN-d	0.943 (0.004)	0.932 (0.000)	0.618 (0.000)	0.590 (0.000)	0.797 (0.017)	0.664 (0.000)	0.836 (0.024)	8
EdgeBank _{tw}	0.888 (0.000)	0.924 (0.000)	0.607 (0.000)	0.840 (0.000)	0.867 (0.000)	0.600 (0.000)	0.733 (0.000)	9
EdgeBank _∞	0.911 (0.000)	0.954 (0.000)	0.548 (0.000)	0.827 (0.000)	0.858 (0.000)	0.538 (0.000)	0.749 (0.000)	10

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.362 (0.005)	0.401 (0.000)	0.133 (0.006)	0.417 (0.005)	0.444 (0.004)	0.451 (0.033)	0.431 (0.029)	11
DyRep-s	0.392 (0.010)	0.504 (0.000)	0.461 (0.035)	0.478 (0.021)	0.590 (0.016)	0.716 (0.068)	0.437 (0.014)	7
TGN-s	0.703 (0.023)	0.689 (0.000)	0.597 (0.049)	0.564 (0.015)	0.656 (0.011)	0.750 (0.058)	0.624 (0.019)	5
JODIE-m	0.364 (0.002)	0.401 (0.000)	0.125 (0.004)	0.410 (0.014)	0.446 (0.001)	0.441 (0.018)	0.385 (0.014)	13
DyRep-m	0.399 (0.013)	0.384 (0.000)	0.499 (0.082)	0.463 (0.002)	0.596 (0.007)	0.738 (0.013)	0.425 (0.037)	8
TGN-m	0.717 (0.004)	0.665 (0.000)	0.633 (0.022)	0.601 (0.035)	0.656 (0.011)	0.644 (0.068)	0.587 (0.102)	5
JODIE-h	0.360 (0.008)	0.319 (0.000)	0.116 (0.003)	0.326 (0.000)	0.446 (0.002)	0.517 (0.000)	0.382 (0.050)	14
DyRep-h	0.390 (0.002)	0.531 (0.000)	0.418 (0.032)	0.463 (0.000)	0.576 (0.042)	0.754 (0.000)	0.447 (0.041)	6
TGN-h	0.726 (0.014)	0.752 (0.000)	0.579 (0.001)	0.605 (0.001)	0.604 (0.023)	0.885 (0.000)	0.697 (0.022)	1
JODIE-d	0.402 (0.018)	0.425 (0.000)	0.128 (0.000)	0.195 (0.000)	0.441 (0.001)	0.493 (0.000)	0.338 (0.024)	12
DyRep-d	0.377 (0.009)	0.481 (0.000)	0.408 (0.000)	0.492 (0.000)	0.593 (0.016)	0.462 (0.000)	0.457 (0.025)	9
TGN-d	0.716 (0.019)	0.723 (0.000)	0.634 (0.000)	0.599 (0.000)	0.645 (0.037)	0.781 (0.000)	0.638 (0.077)	2
EdgeBank _{tw}	0.754 (0.000)	0.748 (0.000)	0.564 (0.000)	0.694 (0.000)	0.606 (0.000)	0.710 (0.000)	0.717 (0.000)	3
EdgeBank _∞	0.492 (0.000)	0.508 (0.000)	0.293 (0.000)	0.493 (0.000)	0.451 (0.000)	0.523 (0.000)	0.381 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.317 (0.003)	0.411 (0.000)	0.261 (0.028)	0.463 (0.004)	0.503 (0.001)	0.450 (0.035)	0.510 (0.020)	10
DyRep-s	0.604 (0.012)	0.535 (0.000)	0.530 (0.002)	0.508 (0.005)	0.584 (0.010)	0.715 (0.062)	0.478 (0.021)	6
TGN-s	0.680 (0.011)	0.675 (0.000)	0.497 (0.018)	0.530 (0.019)	0.690 (0.015)	0.744 (0.055)	0.628 (0.033)	3
JODIE-m	0.316 (0.002)	0.411 (0.001)	0.243 (0.012)	0.460 (0.009)	0.502 (0.003)	0.439 (0.020)	0.476 (0.007)	14
DyRep-m	0.634 (0.024)	0.425 (0.000)	0.516 (0.011)	0.512 (0.013)	0.587 (0.004)	0.729 (0.011)	0.472 (0.030)	7
TGN-m	0.681 (0.006)	0.663 (0.000)	0.524 (0.019)	0.553 (0.026)	0.690 (0.015)	0.641 (0.066)	0.633 (0.056)	4
JODIE-h	0.321 (0.001)	0.362 (0.001)	0.226 (0.013)	0.418 (0.002)	0.502 (0.003)	0.519 (0.000)	0.476 (0.036)	13
DyRep-h	0.598 (0.009)	0.596 (0.000)	0.554 (0.006)	0.509 (0.001)	0.571 (0.036)	0.746 (0.000)	0.485 (0.023)	5
TGN-h	0.692 (0.007)	0.800 (0.000)	0.586 (0.001)	0.531 (0.000)	0.658 (0.007)	0.878 (0.000)	0.688 (0.003)	1
JODIE-d	0.438 (0.015)	0.546 (0.001)	0.264 (0.000)	0.333 (0.000)	0.495 (0.001)	0.491 (0.000)	0.451 (0.010)	11
DyRep-d	0.569 (0.024)	0.469 (0.000)	0.551 (0.000)	0.507 (0.000)	0.595 (0.015)	0.468 (0.000)	0.495 (0.025)	8
TGN-d	0.700 (0.016)	0.731 (0.000)	0.454 (0.000)	0.513 (0.000)	0.671 (0.013)	0.762 (0.000)	0.642 (0.022)	2
EdgeBank _{tw}	0.417 (0.000)	0.439 (0.000)	0.189 (0.000)	0.447 (0.000)	0.484 (0.000)	0.677 (0.000)	0.491 (0.000)	12
EdgeBank _∞	0.435 (0.000)	0.465 (0.000)	0.219 (0.000)	0.463 (0.000)	0.468 (0.000)	0.566 (0.000)	0.515 (0.000)	9

Table B.7: AU-ROC of dynamic link prediction on the "day" granularity data across three negative sampling strategies. Note that we report the mean AU-ROC over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.954 (0.006)	0.931 (0.014)	0.697 (0.003)	0.851 (0.009)	0.908 (0.001)	0.628 (0.057)	0.993 (0.001)	4
DyRep-s	0.582 (0.048)	0.500 (0.000)	0.583 (0.023)	0.510 (0.013)	0.624 (0.027)	0.582 (0.023)	0.828 (0.010)	14
TGN-s	0.916 (0.006)	0.876 (0.000)	0.607 (0.042)	0.631 (0.019)	0.738 (0.037)	0.581 (0.061)	0.846 (0.019)	9
JODIE-m	0.993 (0.002)	0.986 (0.001)	0.760 (0.006)	0.993 (0.005)	0.928 (0.006)	0.600 (0.040)	0.995 (0.000)	1
DyRep-m	0.619 (0.036)	0.531 (0.000)	0.560 (0.030)	0.503 (0.007)	0.644 (0.010)	0.611 (0.017)	0.835 (0.018)	12
TGN-m	0.953 (0.003)	0.850 (0.000)	0.618 (0.035)	0.667 (0.011)	0.802 (0.038)	0.534 (0.025)	0.848 (0.058)	7
JODIE-h	0.962 (0.004)	0.965 (0.000)	0.700 (0.008)	0.857 (0.000)	0.897 (0.014)	0.731 (0.053)	0.994 (0.001)	2
DyRep-h	0.641 (0.015)	0.524 (0.000)	0.592 (0.000)	0.501 (0.000)	0.590 (0.070)	0.615 (0.033)	0.831 (0.016)	13
TGN-h	0.923 (0.012)	0.952 (0.000)	0.703 (0.000)	0.631 (0.000)	0.766 (0.040)	0.625 (0.039)	0.800 (0.025)	6
JODIE-d	0.979 (0.002)	0.942 (0.000)	0.692 (0.000)	0.868 (0.000)	0.914 (0.001)	0.692 (0.003)	0.993 (0.001)	3
DyRep-d	0.692 (0.005)	0.610 (0.000)	0.615 (0.000)	0.519 (0.000)	0.654 (0.010)	0.532 (0.014)	0.834 (0.007)	11
TGN-d	0.947 (0.001)	0.963 (0.000)	0.638 (0.000)	0.636 (0.000)	0.783 (0.029)	0.761 (0.032)	0.843 (0.026)	5
EdgeBank _{tw}	0.890 (0.000)	0.920 (0.000)	0.610 (0.000)	0.840 (0.000)	0.870 (0.000)	0.600 (0.000)	0.730 (0.000)	8
EdgeBank _∞	0.910 (0.000)	0.950 (0.000)	0.550 (0.000)	0.830 (0.000)	0.860 (0.000)	0.540 (0.000)	0.750 (0.000)	10

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.361 (0.002)	0.366 (0.008)	0.153 (0.003)	0.372 (0.001)	0.432 (0.003)	0.402 (0.043)	0.430 (0.030)	12
DyRep-s	0.408 (0.004)	0.476 (0.000)	0.479 (0.048)	0.463 (0.015)	0.580 (0.021)	0.613 (0.034)	0.440 (0.022)	7
TGN-s	0.688 (0.014)	0.684 (0.000)	0.590 (0.056)	0.533 (0.032)	0.633 (0.010)	0.657 (0.055)	0.637 (0.028)	5
JODIE-m	0.364 (0.003)	0.401 (0.005)	0.125 (0.006)	0.410 (0.001)	0.446 (0.001)	0.380 (0.030)	0.385 (0.023)	13
DyRep-m	0.399 (0.013)	0.384 (0.000)	0.499 (0.050)	0.463 (0.003)	0.596 (0.008)	0.645 (0.011)	0.425 (0.028)	9
TGN-m	0.717 (0.014)	0.665 (0.000)	0.633 (0.048)	0.601 (0.036)	0.656 (0.011)	0.583 (0.061)	0.587 (0.100)	4
JODIE-h	0.358 (0.001)	0.385 (0.001)	0.142 (0.011)	0.368 (0.000)	0.431 (0.001)	0.480 (0.046)	0.387 (0.040)	14
DyRep-h	0.383 (0.008)	0.576 (0.000)	0.461 (0.005)	0.441 (0.001)	0.570 (0.039)	0.651 (0.034)	0.448 (0.035)	8
TGN-h	0.692 (0.042)	0.739 (0.000)	0.494 (0.002)	0.618 (0.000)	0.603 (0.047)	0.721 (0.053)	0.646 (0.007)	3
JODIE-d	0.383 (0.010)	0.431 (0.001)	0.144 (0.000)	0.209 (0.000)	0.433 (0.001)	0.452 (0.013)	0.337 (0.020)	11
DyRep-d	0.391 (0.003)	0.485 (0.001)	0.404 (0.000)	0.500 (0.000)	0.599 (0.015)	0.489 (0.016)	0.452 (0.020)	6
TGN-d	0.702 (0.024)	0.764 (0.000)	0.627 (0.000)	0.588 (0.000)	0.637 (0.044)	0.830 (0.022)	0.637 (0.071)	1
EdgeBank _{tw}	0.754 (0.000)	0.748 (0.000)	0.564 (0.000)	0.694 (0.000)	0.606 (0.000)	0.710 (0.000)	0.717 (0.000)	2
EdgeBank _∞	0.492 (0.000)	0.508 (0.000)	0.293 (0.000)	0.493 (0.000)	0.451 (0.000)	0.523 (0.000)	0.381 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.310 (0.001)	0.433 (0.009)	0.209 (0.017)	0.426 (0.001)	0.490 (0.003)	0.414 (0.040)	0.500 (0.020)	11
DyRep-s	0.566 (0.015)	0.519 (0.000)	0.534 (0.050)	0.508 (0.008)	0.584 (0.017)	0.606 (0.026)	0.488 (0.025)	5
TGN-s	0.665 (0.009)	0.673 (0.000)	0.515 (0.039)	0.508 (0.027)	0.645 (0.030)	0.637 (0.043)	0.640 (0.024)	4
JODIE-m	0.316 (0.003)	0.411 (0.007)	0.243 (0.008)	0.460 (0.001)	0.502 (0.001)	0.389 (0.026)	0.476 (0.019)	12
DyRep-m	0.634 (0.010)	0.425 (0.000)	0.516 (0.032)	0.512 (0.009)	0.587 (0.014)	0.632 (0.008)	0.472 (0.024)	8
TGN-m	0.681 (0.011)	0.663 (0.000)	0.524 (0.009)	0.553 (0.009)	0.690 (0.031)	0.595 (0.068)	0.633 (0.063)	3
JODIE-h	0.306 (0.001)	0.453 (0.001)	0.191 (0.007)	0.424 (0.001)	0.484 (0.004)	0.494 (0.052)	0.472 (0.029)	14
DyRep-h	0.532 (0.017)	0.606 (0.000)	0.498 (0.014)	0.487 (0.002)	0.566 (0.037)	0.632 (0.040)	0.492 (0.017)	6
TGN-h	0.649 (0.017)	0.796 (0.000)	0.489 (0.001)	0.529 (0.001)	0.656 (0.014)	0.691 (0.046)	0.650 (0.004)	2
JODIE-d	0.338 (0.009)	0.562 (0.001)	0.212 (0.000)	0.321 (0.000)	0.489 (0.002)	0.461 (0.008)	0.439 (0.016)	13
DyRep-d	0.467 (0.011)	0.522 (0.000)	0.513 (0.000)	0.510 (0.000)	0.595 (0.011)	0.489 (0.019)	0.492 (0.019)	7
TGN-d	0.689 (0.015)	0.825 (0.001)	0.527 (0.000)	0.563 (0.000)	0.672 (0.020)	0.809 (0.027)	0.647 (0.021)	1
EdgeBank _{tw}	0.417 (0.000)	0.439 (0.000)	0.189 (0.000)	0.447 (0.000)	0.484 (0.000)	0.677 (0.000)	0.491 (0.000)	10
EdgeBank _∞	0.435 (0.000)	0.465 (0.000)	0.219 (0.000)	0.463 (0.000)	0.468 (0.000)	0.566 (0.000)	0.515 (0.000)	9

Table B.8: AP of dynamic link prediction on the "second" granularity data across three negative sampling strategies. Note that we report the mean AP over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.993 (0.001)	0.999 (0.000)	0.840 (0.018)	1.000 (0.000)	0.931 (0.006)	0.995 (0.000)	0.993 (0.001)	3
DyRep-s	0.682 (0.008)	0.563 (0.000)	0.614 (0.005)	0.527 (0.003)	0.642 (0.014)	0.728 (0.032)	0.832 (0.002)	12
TGN-s	0.981 (0.001)	0.963 (0.000)	0.764 (0.014)	0.697 (0.014)	0.790 (0.021)	0.902 (0.001)	0.903 (0.005)	6
JODIE-m	0.994 (0.000)	1.000 (0.000)	0.848 (0.010)	0.999 (0.000)	0.926 (0.003)	0.995 (0.001)	0.994 (0.001)	1
DyRep-m	0.684 (0.005)	0.565 (0.000)	0.597 (0.008)	0.518 (0.004)	0.629 (0.020)	0.679 (0.034)	0.831 (0.006)	13
TGN-m	0.980 (0.001)	0.954 (0.000)	0.779 (0.024)	0.699 (0.015)	0.789 (0.022)	0.821 (0.008)	0.907 (0.036)	5
JODIE-h	0.994 (0.001)	0.996 (0.000)	0.847 (0.018)	0.998 (0.000)	0.925 (0.018)	0.861 (0.000)	0.994 (0.001)	2
DyRep-h	0.656 (0.014)	0.514 (0.000)	0.602 (0.007)	0.526 (0.000)	0.600 (0.042)	0.679 (0.000)	0.818 (0.020)	14
TGN-h	0.962 (0.001)	0.923 (0.000)	0.660 (0.000)	0.685 (0.000)	0.727 (0.029)	0.533 (0.000)	0.790 (0.019)	8
JODIE-d	0.978 (0.006)	0.884 (0.000)	0.643 (0.000)	0.936 (0.000)	0.920 (0.004)	0.611 (0.000)	0.994 (0.001)	4
DyRep-d	0.605 (0.027)	0.490 (0.000)	0.608 (0.000)	0.526 (0.000)	0.650 (0.003)	0.506 (0.000)	0.834 (0.006)	11
TGN-d	0.944 (0.004)	0.918 (0.000)	0.557 (0.000)	0.602 (0.000)	0.760 (0.014)	0.543 (0.000)	0.836 (0.027)	9
EdgeBank _{tw}	0.887 (0.000)	0.921 (0.000)	0.576 (0.000)	0.784 (0.000)	0.826 (0.000)	0.556 (0.000)	0.730 (0.000)	7
EdgeBank _∞	0.908 (0.000)	0.949 (0.000)	0.529 (0.000)	0.761 (0.000)	0.811 (0.000)	0.520 (0.000)	0.739 (0.000)	10

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.417 (0.002)	0.435 (0.003)	0.336 (0.002)	0.454 (0.003)	0.440 (0.001)	0.517 (0.012)	0.457 (0.021)	11
DyRep-s	0.418 (0.001)	0.437 (0.000)	0.427 (0.003)	0.476 (0.011)	0.585 (0.021)	0.717 (0.040)	0.440 (0.007)	7
TGN-s	0.827 (0.019)	0.746 (0.000)	0.644 (0.043)	0.628 (0.010)	0.649 (0.014)	0.916 (0.010)	0.777 (0.013)	2
JODIE-m	0.419 (0.001)	0.434 (0.005)	0.334 (0.003)	0.451 (0.006)	0.441 (0.001)	0.508 (0.013)	0.430 (0.005)	12
DyRep-m	0.411 (0.006)	0.457 (0.000)	0.417 (0.002)	0.463 (0.006)	0.588 (0.011)	0.698 (0.029)	0.435 (0.016)	9
TGN-m	0.804 (0.016)	0.704 (0.000)	0.644 (0.046)	0.684 (0.034)	0.649 (0.014)	0.820 (0.060)	0.748 (0.056)	1
JODIE-h	0.416 (0.004)	0.403 (0.000)	0.329 (0.001)	0.407 (0.000)	0.441 (0.001)	0.469 (0.000)	0.429 (0.023)	14
DyRep-h	0.419 (0.004)	0.519 (0.000)	0.434 (0.012)	0.463 (0.001)	0.558 (0.032)	0.725 (0.000)	0.445 (0.014)	8
TGN-h	0.721 (0.023)	0.713 (0.000)	0.565 (0.001)	0.644 (0.001)	0.588 (0.011)	0.579 (0.000)	0.623 (0.036)	5
JODIE-d	0.417 (0.007)	0.409 (0.000)	0.354 (0.000)	0.347 (0.000)	0.440 (0.000)	0.471 (0.000)	0.405 (0.011)	13
DyRep-d	0.414 (0.001)	0.455 (0.000)	0.421 (0.000)	0.471 (0.000)	0.590 (0.005)	0.454 (0.000)	0.459 (0.013)	6
TGN-d	0.709 (0.037)	0.716 (0.000)	0.633 (0.000)	0.622 (0.000)	0.627 (0.029)	0.549 (0.000)	0.614 (0.091)	4
EdgeBank _{tw}	0.689 (0.000)	0.676 (0.000)	0.541 (0.000)	0.627 (0.000)	0.568 (0.000)	0.633 (0.000)	0.701 (0.000)	3
EdgeBank _∞	0.496 (0.000)	0.504 (0.000)	0.432 (0.000)	0.497 (0.000)	0.483 (0.000)	0.512 (0.000)	0.455 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.412 (0.002)	0.443 (0.003)	0.444 (0.028)	0.477 (0.002)	0.473 (0.000)	0.519 (0.012)	0.501 (0.013)	9
DyRep-s	0.626 (0.005)	0.481 (0.000)	0.599 (0.002)	0.519 (0.002)	0.586 (0.018)	0.714 (0.036)	0.491 (0.005)	6
TGN-s	0.840 (0.007)	0.833 (0.000)	0.658 (0.027)	0.601 (0.008)	0.693 (0.011)	0.910 (0.010)	0.782 (0.025)	1
JODIE-m	0.411 (0.001)	0.443 (0.004)	0.430 (0.014)	0.476 (0.004)	0.473 (0.001)	0.510 (0.015)	0.480 (0.006)	14
DyRep-m	0.614 (0.025)	0.509 (0.000)	0.558 (0.015)	0.511 (0.006)	0.582 (0.017)	0.691 (0.032)	0.499 (0.017)	8
TGN-m	0.807 (0.005)	0.807 (0.000)	0.628 (0.022)	0.640 (0.029)	0.692 (0.011)	0.808 (0.061)	0.779 (0.024)	2
JODIE-h	0.414 (0.000)	0.429 (0.000)	0.411 (0.018)	0.453 (0.000)	0.473 (0.002)	0.467 (0.000)	0.482 (0.020)	11
DyRep-h	0.617 (0.009)	0.584 (0.000)	0.586 (0.005)	0.510 (0.001)	0.563 (0.025)	0.712 (0.000)	0.500 (0.010)	7
TGN-h	0.704 (0.009)	0.764 (0.000)	0.532 (0.000)	0.576 (0.000)	0.641 (0.014)	0.565 (0.000)	0.633 (0.019)	3
JODIE-d	0.487 (0.012)	0.499 (0.000)	0.518 (0.000)	0.418 (0.000)	0.471 (0.000)	0.471 (0.000)	0.466 (0.004)	12
DyRep-d	0.608 (0.018)	0.472 (0.000)	0.561 (0.000)	0.524 (0.000)	0.595 (0.006)	0.458 (0.000)	0.516 (0.009)	5
TGN-d	0.716 (0.023)	0.744 (0.000)	0.487 (0.000)	0.538 (0.000)	0.659 (0.017)	0.533 (0.000)	0.644 (0.038)	4
EdgeBank _{tw}	0.469 (0.000)	0.473 (0.000)	0.417 (0.000)	0.481 (0.000)	0.506 (0.000)	0.609 (0.000)	0.566 (0.000)	13
EdgeBank _∞	0.477 (0.000)	0.485 (0.000)	0.417 (0.000)	0.487 (0.000)	0.497 (0.000)	0.536 (0.000)	0.570 (0.000)	10

Table B.9: AP of dynamic link prediction on the "minute" granularity data across three negative sampling strategies. Note that we report the mean AP over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.993 (0.001)	0.999 (0.000)	0.840 (0.018)	1.000 (0.000)	0.931 (0.006)	0.995 (0.000)	0.993 (0.001)	2
DyRep-s	0.680 (0.006)	0.565 (0.000)	0.611 (0.007)	0.529 (0.005)	0.635 (0.014)	0.731 (0.033)	0.827 (0.003)	11
TGN-s	0.979 (0.001)	0.963 (0.000)	0.725 (0.023)	0.697 (0.013)	0.790 (0.020)	0.784 (0.011)	0.895 (0.009)	5
JODIE-m	0.994 (0.000)	1.000 (0.000)	0.848 (0.009)	0.999 (0.000)	0.928 (0.003)	0.994 (0.001)	0.994 (0.001)	1
DyRep-m	0.683 (0.004)	0.562 (0.000)	0.596 (0.007)	0.523 (0.002)	0.628 (0.010)	0.677 (0.032)	0.832 (0.008)	12
TGN-m	0.979 (0.001)	0.954 (0.000)	0.777 (0.024)	0.697 (0.016)	0.791 (0.020)	0.832 (0.009)	0.897 (0.033)	4
JODIE-h	0.994 (0.001)	0.996 (0.000)	0.846 (0.020)	0.998 (0.000)	0.924 (0.017)	0.853 (0.000)	0.994 (0.001)	3
DyRep-h	0.655 (0.016)	0.515 (0.000)	0.603 (0.007)	0.522 (0.000)	0.601 (0.042)	0.668 (0.000)	0.817 (0.022)	13
TGN-h	0.962 (0.001)	0.925 (0.000)	0.660 (0.000)	0.682 (0.000)	0.728 (0.029)	0.562 (0.000)	0.791 (0.018)	7
JODIE-d	0.979 (0.006)	0.882 (0.000)	0.648 (0.000)	0.939 (0.000)	0.921 (0.002)	0.607 (0.000)	0.994 (0.001)	6
DyRep-d	0.607 (0.026)	0.491 (0.000)	0.609 (0.000)	0.521 (0.000)	0.640 (0.011)	0.516 (0.000)	0.832 (0.008)	14
TGN-d	0.945 (0.004)	0.918 (0.000)	0.559 (0.000)	0.601 (0.000)	0.760 (0.014)	0.536 (0.000)	0.836 (0.027)	10
EdgeBank _{tw}	0.887 (0.000)	0.921 (0.000)	0.576 (0.000)	0.784 (0.000)	0.826 (0.000)	0.556 (0.000)	0.730 (0.000)	8
EdgeBank _∞	0.908 (0.000)	0.949 (0.000)	0.529 (0.000)	0.761 (0.000)	0.811 (0.000)	0.520 (0.000)	0.739 (0.000)	9

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.418 (0.002)	0.435 (0.003)	0.337 (0.002)	0.454 (0.003)	0.440 (0.000)	0.516 (0.012)	0.456 (0.021)	11
DyRep-s	0.417 (0.002)	0.438 (0.000)	0.425 (0.004)	0.476 (0.013)	0.575 (0.024)	0.719 (0.041)	0.440 (0.007)	7
TGN-s	0.821 (0.020)	0.742 (0.000)	0.629 (0.043)	0.626 (0.008)	0.651 (0.012)	0.838 (0.017)	0.767 (0.014)	1
JODIE-m	0.420 (0.001)	0.434 (0.005)	0.335 (0.002)	0.451 (0.006)	0.440 (0.001)	0.507 (0.013)	0.430 (0.005)	12
DyRep-m	0.410 (0.005)	0.453 (0.000)	0.417 (0.001)	0.460 (0.004)	0.584 (0.011)	0.694 (0.027)	0.434 (0.016)	8
TGN-m	0.802 (0.020)	0.702 (0.000)	0.636 (0.047)	0.683 (0.033)	0.651 (0.012)	0.881 (0.039)	0.732 (0.056)	2
JODIE-h	0.417 (0.004)	0.403 (0.000)	0.330 (0.001)	0.407 (0.000)	0.440 (0.001)	0.467 (0.000)	0.429 (0.023)	14
DyRep-h	0.418 (0.005)	0.516 (0.000)	0.432 (0.011)	0.464 (0.000)	0.572 (0.038)	0.714 (0.000)	0.445 (0.015)	6
TGN-h	0.725 (0.022)	0.716 (0.000)	0.557 (0.001)	0.639 (0.002)	0.586 (0.012)	0.628 (0.000)	0.623 (0.035)	5
JODIE-d	0.418 (0.006)	0.409 (0.001)	0.354 (0.000)	0.347 (0.000)	0.439 (0.001)	0.484 (0.000)	0.405 (0.011)	13
DyRep-d	0.414 (0.002)	0.458 (0.000)	0.424 (0.000)	0.473 (0.000)	0.582 (0.006)	0.458 (0.000)	0.458 (0.014)	9
TGN-d	0.709 (0.038)	0.714 (0.000)	0.633 (0.000)	0.624 (0.000)	0.627 (0.030)	0.575 (0.000)	0.616 (0.090)	4
EdgeBank _{tw}	0.688 (0.000)	0.675 (0.000)	0.541 (0.000)	0.627 (0.000)	0.567 (0.000)	0.634 (0.000)	0.701 (0.000)	3
EdgeBank _∞	0.496 (0.000)	0.504 (0.000)	0.432 (0.000)	0.497 (0.000)	0.483 (0.000)	0.512 (0.000)	0.455 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.412 (0.002)	0.443 (0.003)	0.445 (0.028)	0.478 (0.002)	0.473 (0.000)	0.520 (0.013)	0.500 (0.013)	9
DyRep-s	0.625 (0.004)	0.483 (0.000)	0.594 (0.003)	0.527 (0.011)	0.579 (0.018)	0.716 (0.037)	0.491 (0.005)	6
TGN-s	0.833 (0.008)	0.832 (0.000)	0.630 (0.012)	0.601 (0.008)	0.695 (0.009)	0.825 (0.019)	0.771 (0.025)	1
JODIE-m	0.411 (0.001)	0.443 (0.004)	0.431 (0.015)	0.476 (0.004)	0.472 (0.001)	0.510 (0.015)	0.480 (0.006)	12
DyRep-m	0.611 (0.025)	0.504 (0.000)	0.557 (0.010)	0.502 (0.008)	0.580 (0.014)	0.688 (0.029)	0.498 (0.016)	7
TGN-m	0.805 (0.000)	0.807 (0.000)	0.620 (0.015)	0.640 (0.028)	0.695 (0.010)	0.870 (0.039)	0.763 (0.025)	2
JODIE-h	0.415 (0.001)	0.429 (0.000)	0.412 (0.018)	0.453 (0.000)	0.473 (0.002)	0.466 (0.000)	0.483 (0.020)	14
DyRep-h	0.615 (0.011)	0.579 (0.000)	0.586 (0.004)	0.501 (0.001)	0.572 (0.031)	0.699 (0.000)	0.499 (0.010)	5
TGN-h	0.708 (0.011)	0.771 (0.000)	0.531 (0.001)	0.572 (0.000)	0.640 (0.012)	0.612 (0.000)	0.630 (0.016)	3
JODIE-d	0.487 (0.012)	0.498 (0.000)	0.518 (0.000)	0.418 (0.000)	0.472 (0.000)	0.481 (0.000)	0.466 (0.005)	13
DyRep-d	0.614 (0.022)	0.479 (0.000)	0.566 (0.000)	0.524 (0.000)	0.589 (0.012)	0.461 (0.000)	0.514 (0.014)	8
TGN-d	0.715 (0.023)	0.746 (0.000)	0.483 (0.000)	0.539 (0.000)	0.659 (0.017)	0.558 (0.000)	0.644 (0.041)	4
EdgeBank _{tw}	0.469 (0.000)	0.473 (0.000)	0.417 (0.000)	0.481 (0.000)	0.506 (0.000)	0.609 (0.000)	0.566 (0.000)	11
EdgeBank _∞	0.477 (0.000)	0.485 (0.000)	0.417 (0.000)	0.487 (0.000)	0.497 (0.000)	0.536 (0.000)	0.570 (0.000)	10

Table B.10: AP of dynamic link prediction on the "hour" granularity data across three negative sampling strategies. Note that we report the mean AP over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.992 (0.001)	0.989 (0.001)	0.779 (0.010)	0.994 (0.000)	0.933 (0.006)	0.760 (0.042)	0.993 (0.001)	3
DyRep-s	0.573 (0.013)	0.515 (0.000)	0.599 (0.006)	0.528 (0.004)	0.636 (0.014)	0.730 (0.037)	0.823 (0.002)	14
TGN-s	0.952 (0.005)	0.895 (0.000)	0.594 (0.015)	0.660 (0.012)	0.775 (0.031)	0.613 (0.024)	0.837 (0.003)	6
JODIE-m	0.994 (0.000)	0.988 (0.000)	0.778 (0.005)	0.994 (0.000)	0.929 (0.004)	0.772 (0.031)	0.994 (0.001)	2
DyRep-m	0.639 (0.018)	0.540 (0.000)	0.576 (0.028)	0.525 (0.004)	0.643 (0.004)	0.671 (0.047)	0.830 (0.015)	13
TGN-m	0.956 (0.002)	0.830 (0.000)	0.602 (0.035)	0.664 (0.015)	0.775 (0.031)	0.592 (0.048)	0.830 (0.070)	7
JODIE-h	0.993 (0.001)	0.993 (0.000)	0.802 (0.006)	0.994 (0.000)	0.927 (0.017)	0.882 (0.000)	0.994 (0.001)	1
DyRep-h	0.676 (0.006)	0.631 (0.000)	0.629 (0.002)	0.528 (0.000)	0.612 (0.038)	0.670 (0.000)	0.824 (0.015)	11
TGN-h	0.960 (0.001)	0.967 (0.000)	0.682 (0.000)	0.687 (0.000)	0.739 (0.023)	0.787 (0.000)	0.833 (0.015)	5
JODIE-d	0.981 (0.004)	0.926 (0.000)	0.738 (0.000)	0.946 (0.000)	0.922 (0.007)	0.738 (0.000)	0.994 (0.001)	4
DyRep-d	0.616 (0.022)	0.535 (0.000)	0.626 (0.000)	0.523 (0.000)	0.652 (0.012)	0.490 (0.000)	0.837 (0.008)	12
TGN-d	0.946 (0.003)	0.925 (0.000)	0.609 (0.000)	0.597 (0.000)	0.765 (0.016)	0.596 (0.000)	0.835 (0.027)	8
EdgeBank _{tw}	0.887 (0.000)	0.921 (0.000)	0.576 (0.000)	0.784 (0.000)	0.826 (0.000)	0.556 (0.000)	0.730 (0.000)	9
EdgeBank _∞	0.908 (0.000)	0.949 (0.000)	0.529 (0.000)	0.761 (0.000)	0.811 (0.000)	0.520 (0.000)	0.739 (0.000)	10

(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.421 (0.002)	0.449 (0.000)	0.334 (0.002)	0.455 (0.002)	0.441 (0.002)	0.441 (0.013)	0.457 (0.017)	11
DyRep-s	0.424 (0.006)	0.486 (0.000)	0.450 (0.014)	0.474 (0.012)	0.583 (0.019)	0.720 (0.047)	0.437 (0.006)	7
TGN-s	0.689 (0.034)	0.638 (0.000)	0.551 (0.036)	0.588 (0.012)	0.635 (0.025)	0.658 (0.073)	0.587 (0.034)	5
JODIE-m	0.422 (0.001)	0.449 (0.000)	0.332 (0.001)	0.451 (0.007)	0.442 (0.000)	0.436 (0.006)	0.431 (0.009)	13
DyRep-m	0.424 (0.006)	0.416 (0.000)	0.478 (0.054)	0.465 (0.003)	0.592 (0.002)	0.695 (0.036)	0.436 (0.018)	8
TGN-m	0.704 (0.008)	0.638 (0.000)	0.571 (0.016)	0.627 (0.036)	0.635 (0.024)	0.552 (0.056)	0.572 (0.114)	5
JODIE-h	0.420 (0.003)	0.405 (0.000)	0.330 (0.001)	0.407 (0.000)	0.442 (0.001)	0.466 (0.000)	0.430 (0.027)	14
DyRep-h	0.422 (0.002)	0.496 (0.000)	0.430 (0.016)	0.461 (0.000)	0.575 (0.034)	0.705 (0.000)	0.445 (0.019)	6
TGN-h	0.728 (0.008)	0.712 (0.000)	0.516 (0.001)	0.643 (0.000)	0.591 (0.022)	0.854 (0.000)	0.695 (0.021)	1
JODIE-d	0.421 (0.007)	0.426 (0.000)	0.333 (0.000)	0.347 (0.000)	0.440 (0.001)	0.458 (0.000)	0.406 (0.010)	12
DyRep-d	0.415 (0.004)	0.471 (0.000)	0.426 (0.000)	0.470 (0.000)	0.593 (0.013)	0.461 (0.000)	0.456 (0.017)	9
TGN-d	0.707 (0.043)	0.689 (0.000)	0.573 (0.000)	0.609 (0.000)	0.627 (0.034)	0.678 (0.000)	0.619 (0.087)	2
EdgeBank _{tw}	0.689 (0.000)	0.676 (0.000)	0.541 (0.000)	0.627 (0.000)	0.568 (0.000)	0.633 (0.000)	0.701 (0.000)	3
EdgeBank _∞	0.496 (0.000)	0.504 (0.000)	0.432 (0.000)	0.497 (0.000)	0.483 (0.000)	0.512 (0.000)	0.455 (0.000)	10

(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.412 (0.002)	0.454 (0.000)	0.421 (0.029)	0.477 (0.002)	0.474 (0.001)	0.441 (0.013)	0.500 (0.013)	10
DyRep-s	0.606 (0.009)	0.555 (0.000)	0.572 (0.004)	0.519 (0.002)	0.584 (0.013)	0.720 (0.045)	0.488 (0.006)	6
TGN-s	0.686 (0.020)	0.649 (0.000)	0.519 (0.012)	0.560 (0.015)	0.679 (0.019)	0.654 (0.069)	0.620 (0.047)	3
JODIE-m	0.411 (0.001)	0.454 (0.000)	0.406 (0.010)	0.475 (0.005)	0.474 (0.001)	0.436 (0.007)	0.479 (0.005)	14
DyRep-m	0.650 (0.017)	0.460 (0.000)	0.545 (0.023)	0.524 (0.010)	0.587 (0.008)	0.689 (0.036)	0.493 (0.014)	7
TGN-m	0.691 (0.005)	0.675 (0.000)	0.539 (0.017)	0.581 (0.024)	0.679 (0.019)	0.551 (0.054)	0.625 (0.075)	4
JODIE-h	0.415 (0.001)	0.426 (0.000)	0.403 (0.016)	0.452 (0.001)	0.474 (0.002)	0.467 (0.000)	0.481 (0.020)	13
DyRep-h	0.623 (0.005)	0.576 (0.000)	0.584 (0.000)	0.516 (0.001)	0.572 (0.028)	0.696 (0.000)	0.496 (0.015)	5
TGN-h	0.710 (0.007)	0.820 (0.000)	0.589 (0.000)	0.576 (0.001)	0.643 (0.006)	0.847 (0.000)	0.692 (0.006)	1
JODIE-d	0.489 (0.013)	0.552 (0.000)	0.446 (0.000)	0.416 (0.000)	0.471 (0.000)	0.458 (0.000)	0.466 (0.003)	11
DyRep-d	0.606 (0.013)	0.482 (0.000)	0.587 (0.000)	0.511 (0.000)	0.597 (0.010)	0.466 (0.000)	0.509 (0.020)	8
TGN-d	0.719 (0.029)	0.731 (0.000)	0.484 (0.000)	0.537 (0.000)	0.659 (0.014)	0.661 (0.000)	0.646 (0.042)	2
EdgeBank _{tw}	0.469 (0.000)	0.473 (0.000)	0.417 (0.000)	0.481 (0.000)	0.506 (0.000)	0.609 (0.000)	0.566 (0.000)	12
EdgeBank _∞	0.477 (0.000)	0.485 (0.000)	0.417 (0.000)	0.487 (0.000)	0.497 (0.000)	0.536 (0.000)	0.570 (0.000)	9

Table B.11: AP of dynamic link prediction on the "day" granularity data across three negative sampling strategies. Note that we report the mean AP over three runs with the standard deviations in parenthesis, and the rank is computed by averaging the ranks over all datasets.

(a) Random Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.958 (0.006)	0.934 (0.013)	0.717 (0.001)	0.882 (0.007)	0.909 (0.001)	0.587 (0.056)	0.991 (0.002)	4
DyRep-s	0.587 (0.047)	0.522 (0.000)	0.592 (0.015)	0.531 (0.004)	0.630 (0.023)	0.621 (0.037)	0.814 (0.009)	14
TGN-s	0.922 (0.005)	0.847 (0.000)	0.584 (0.034)	0.635 (0.017)	0.699 (0.044)	0.532 (0.046)	0.835 (0.026)	9
JODIE-m	0.969 (0.002)	0.936 (0.003)	0.711 (0.007)	0.876 (0.004)	0.898 (0.008)	0.556 (0.037)	0.993 (0.001)	1
DyRep-m	0.616 (0.033)	0.546 (0.000)	0.575 (0.025)	0.526 (0.006)	0.633 (0.010)	0.612 (0.031)	0.813 (0.021)	12
TGN-m	0.941 (0.004)	0.857 (0.000)	0.599 (0.027)	0.643 (0.008)	0.700 (0.044)	0.493 (0.016)	0.820 (0.070)	7
JODIE-h	0.966 (0.004)	0.965 (0.000)	0.724 (0.006)	0.888 (0.000)	0.897 (0.014)	0.682 (0.052)	0.993 (0.001)	2
DyRep-h	0.648 (0.005)	0.539 (0.000)	0.600 (0.003)	0.518 (0.000)	0.599 (0.053)	0.649 (0.019)	0.818 (0.015)	13
TGN-h	0.929 (0.010)	0.947 (0.000)	0.676 (0.000)	0.645 (0.000)	0.730 (0.033)	0.568 (0.045)	0.788 (0.025)	6
JODIE-d	0.982 (0.002)	0.933 (0.000)	0.720 (0.000)	0.894 (0.000)	0.913 (0.001)	0.642 (0.015)	0.993 (0.001)	3
DyRep-d	0.691 (0.002)	0.592 (0.000)	0.615 (0.000)	0.539 (0.000)	0.655 (0.009)	0.538 (0.015)	0.828 (0.007)	11
TGN-d	0.951 (0.000)	0.961 (0.000)	0.620 (0.000)	0.655 (0.000)	0.752 (0.029)	0.704 (0.036)	0.840 (0.029)	5
EdgeBank _{tw}	0.887 (0.000)	0.921 (0.000)	0.576 (0.000)	0.784 (0.000)	0.826 (0.000)	0.556 (0.000)	0.730 (0.000)	8
EdgeBank _∞	0.908 (0.000)	0.949 (0.000)	0.529 (0.000)	0.761 (0.000)	0.811 (0.000)	0.520 (0.000)	0.739 (0.000)	10
(b) Historical Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.421 (0.001)	0.411 (0.002)	0.339 (0.001)	0.432 (0.000)	0.438 (0.001)	0.418 (0.016)	0.457 (0.017)	12
DyRep-s	0.434 (0.002)	0.465 (0.000)	0.459 (0.022)	0.464 (0.008)	0.582 (0.022)	0.621 (0.033)	0.440 (0.009)	7
TGN-s	0.690 (0.027)	0.633 (0.000)	0.552 (0.041)	0.559 (0.029)	0.601 (0.014)	0.565 (0.045)	0.603 (0.034)	5
JODIE-m	0.421 (0.001)	0.412 (0.002)	0.337 (0.002)	0.431 (0.000)	0.438 (0.000)	0.409 (0.011)	0.436 (0.012)	13
DyRep-m	0.427 (0.006)	0.476 (0.000)	0.502 (0.057)	0.451 (0.001)	0.589 (0.011)	0.631 (0.023)	0.435 (0.014)	9
TGN-m	0.679 (0.005)	0.699 (0.000)	0.564 (0.042)	0.626 (0.033)	0.601 (0.015)	0.512 (0.044)	0.553 (0.106)	4
JODIE-h	0.420 (0.000)	0.417 (0.000)	0.336 (0.003)	0.430 (0.000)	0.437 (0.000)	0.450 (0.022)	0.432 (0.023)	14
DyRep-h	0.419 (0.003)	0.531 (0.000)	0.449 (0.012)	0.449 (0.001)	0.573 (0.036)	0.656 (0.027)	0.445 (0.016)	8
TGN-h	0.688 (0.047)	0.693 (0.000)	0.467 (0.001)	0.648 (0.001)	0.581 (0.033)	0.631 (0.063)	0.627 (0.008)	3
JODIE-d	0.415 (0.004)	0.426 (0.000)	0.337 (0.000)	0.353 (0.000)	0.438 (0.000)	0.436 (0.006)	0.407 (0.009)	11
DyRep-d	0.421 (0.001)	0.467 (0.000)	0.420 (0.000)	0.485 (0.000)	0.604 (0.016)	0.488 (0.008)	0.455 (0.015)	6
TGN-d	0.690 (0.044)	0.725 (0.001)	0.562 (0.000)	0.591 (0.000)	0.620 (0.044)	0.776 (0.036)	0.619 (0.089)	1
EdgeBank _{tw}	0.689 (0.000)	0.676 (0.000)	0.541 (0.000)	0.627 (0.000)	0.568 (0.000)	0.633 (0.000)	0.701 (0.000)	2
EdgeBank _∞	0.496 (0.000)	0.504 (0.000)	0.432 (0.000)	0.497 (0.000)	0.483 (0.000)	0.512 (0.000)	0.455 (0.000)	10
EdgeBank _∞	0.908 (0.000)	0.949 (0.000)	0.529 (0.000)	0.761 (0.000)	0.811 (0.000)	0.520 (0.000)	0.739 (0.000)	10
(c) Inductive Sampling								
Method	Wikipedia	Reddit	MOOC	LastFM	Enron	Social Evo.	UCI	Rank
JODIE-s	0.400 (0.000)	0.441 (0.003)	0.377 (0.024)	0.458 (0.000)	0.469 (0.001)	0.423 (0.015)	0.497 (0.012)	11
DyRep-s	0.589 (0.014)	0.522 (0.000)	0.565 (0.037)	0.523 (0.003)	0.586 (0.017)	0.617 (0.034)	0.492 (0.009)	5
TGN-s	0.667 (0.019)	0.644 (0.000)	0.532 (0.029)	0.543 (0.029)	0.631 (0.032)	0.555 (0.035)	0.637 (0.023)	4
JODIE-m	0.401 (0.001)	0.442 (0.003)	0.363 (0.011)	0.458 (0.000)	0.469 (0.000)	0.413 (0.009)	0.482 (0.010)	12
DyRep-m	0.602 (0.010)	0.522 (0.000)	0.544 (0.024)	0.507 (0.008)	0.582 (0.013)	0.620 (0.023)	0.486 (0.011)	8
TGN-m	0.675 (0.013)	0.709 (0.000)	0.542 (0.009)	0.558 (0.007)	0.631 (0.032)	0.527 (0.050)	0.605 (0.080)	3
JODIE-h	0.399 (0.000)	0.448 (0.000)	0.366 (0.015)	0.457 (0.001)	0.467 (0.002)	0.457 (0.026)	0.480 (0.017)	14
DyRep-h	0.572 (0.009)	0.592 (0.000)	0.537 (0.015)	0.501 (0.001)	0.570 (0.033)	0.644 (0.026)	0.498 (0.011)	6
TGN-h	0.654 (0.011)	0.797 (0.000)	0.503 (0.000)	0.565 (0.001)	0.633 (0.016)	0.610 (0.056)	0.656 (0.003)	2
JODIE-d	0.426 (0.007)	0.527 (0.001)	0.402 (0.000)	0.408 (0.000)	0.469 (0.001)	0.440 (0.004)	0.463 (0.005)	13
DyRep-d	0.530 (0.009)	0.507 (0.000)	0.545 (0.000)	0.520 (0.000)	0.599 (0.010)	0.490 (0.004)	0.504 (0.015)	7
TGN-d	0.702 (0.020)	0.832 (0.001)	0.529 (0.000)	0.591 (0.000)	0.662 (0.024)	0.749 (0.036)	0.649 (0.040)	1
EdgeBank _{tw}	0.469 (0.000)	0.473 (0.000)	0.417 (0.000)	0.481 (0.000)	0.506 (0.000)	0.609 (0.000)	0.566 (0.000)	10
EdgeBank _∞	0.477 (0.000)	0.485 (0.000)	0.417 (0.000)	0.487 (0.000)	0.497 (0.000)	0.536 (0.000)	0.570 (0.000)	9