

The Knight's Tour

Graphs, Algorithms, Abstraction and Decomposition

Based on the work of Paul Curzon / CS4fn

CS4FN

A Computer Science for Fun/Teaching London Computing/CHI+MED Special

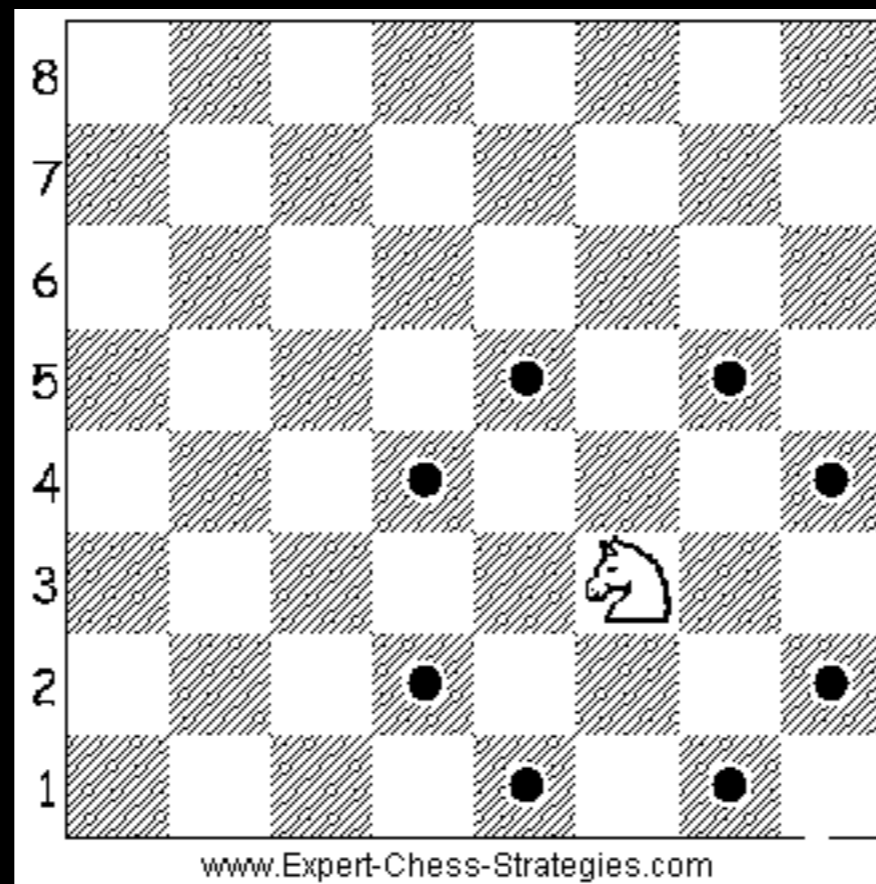


Mark Clarkson

Secret Objectives

- Understand the terms:
 - Abstraction
 - Modelling
 - Decomposition
 - Generalisation
 - Graph

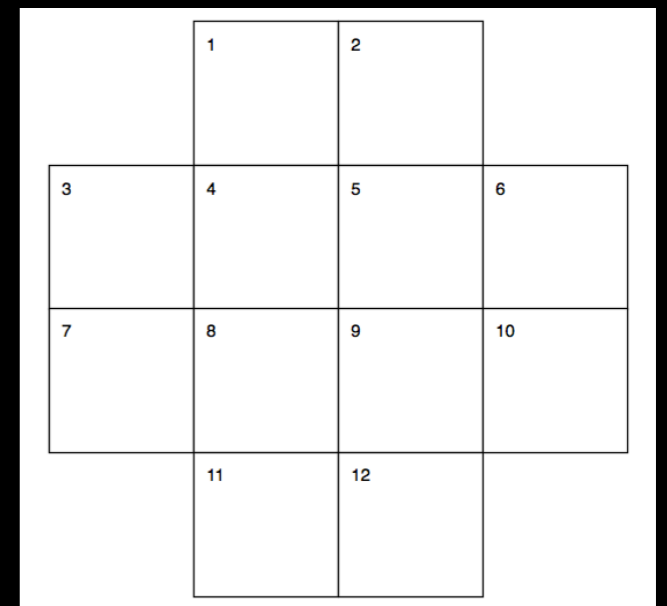
The Knight



The Knight's Tour

The challenge:

- Visit each space on the grid **exactly once**
- End up back at **square one**

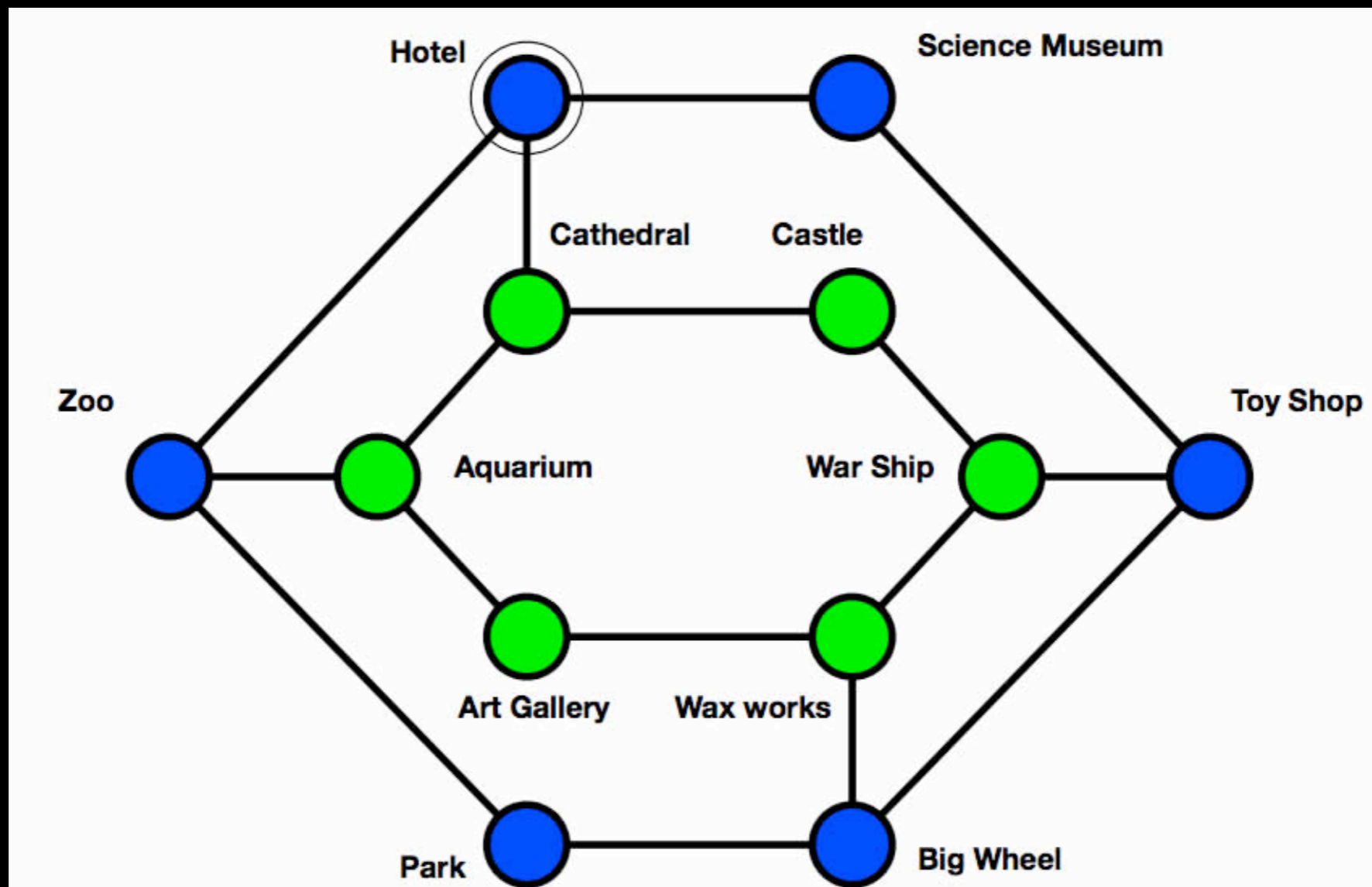


Decomposition

- Break a big task into several smaller tasks
- Instead of ‘visit all squares at least once’, break it down into a series of specific steps
- *“Divide and conquer”*

A different challenge

Start and end at the hotel



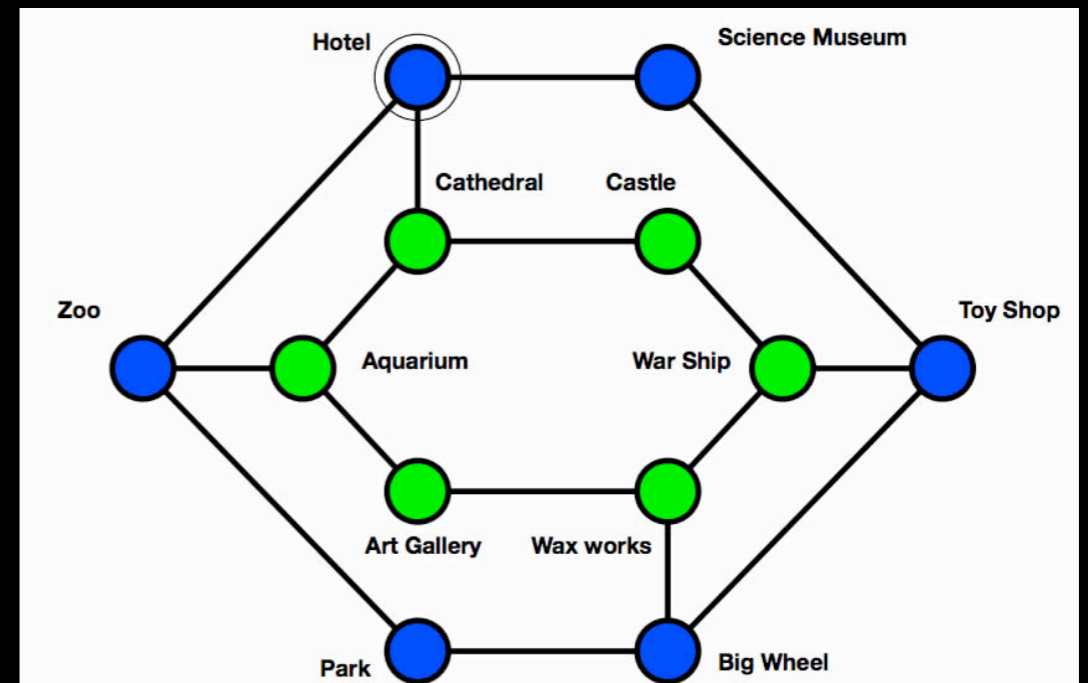
Which is easier? Why?



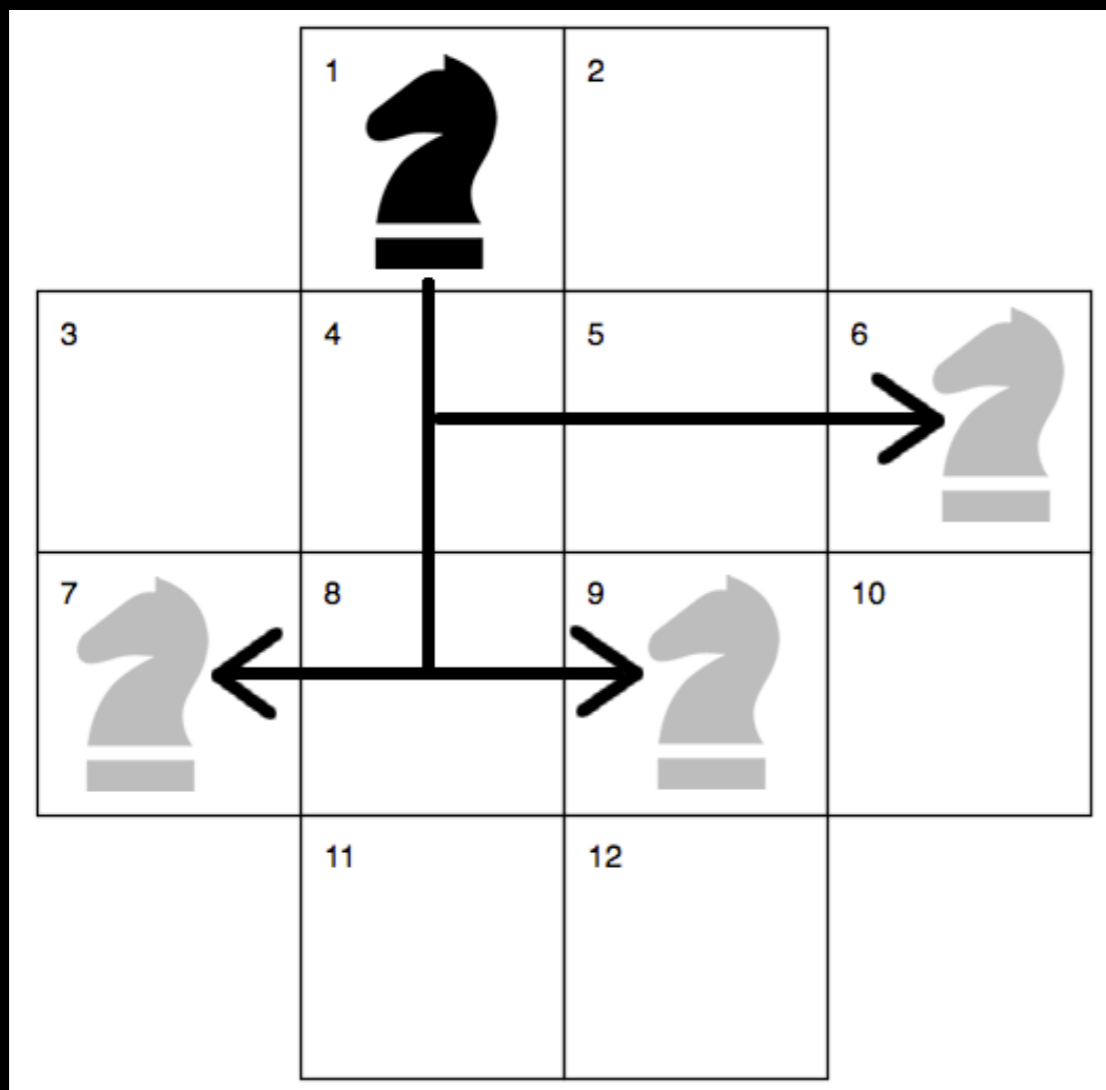
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Graphs

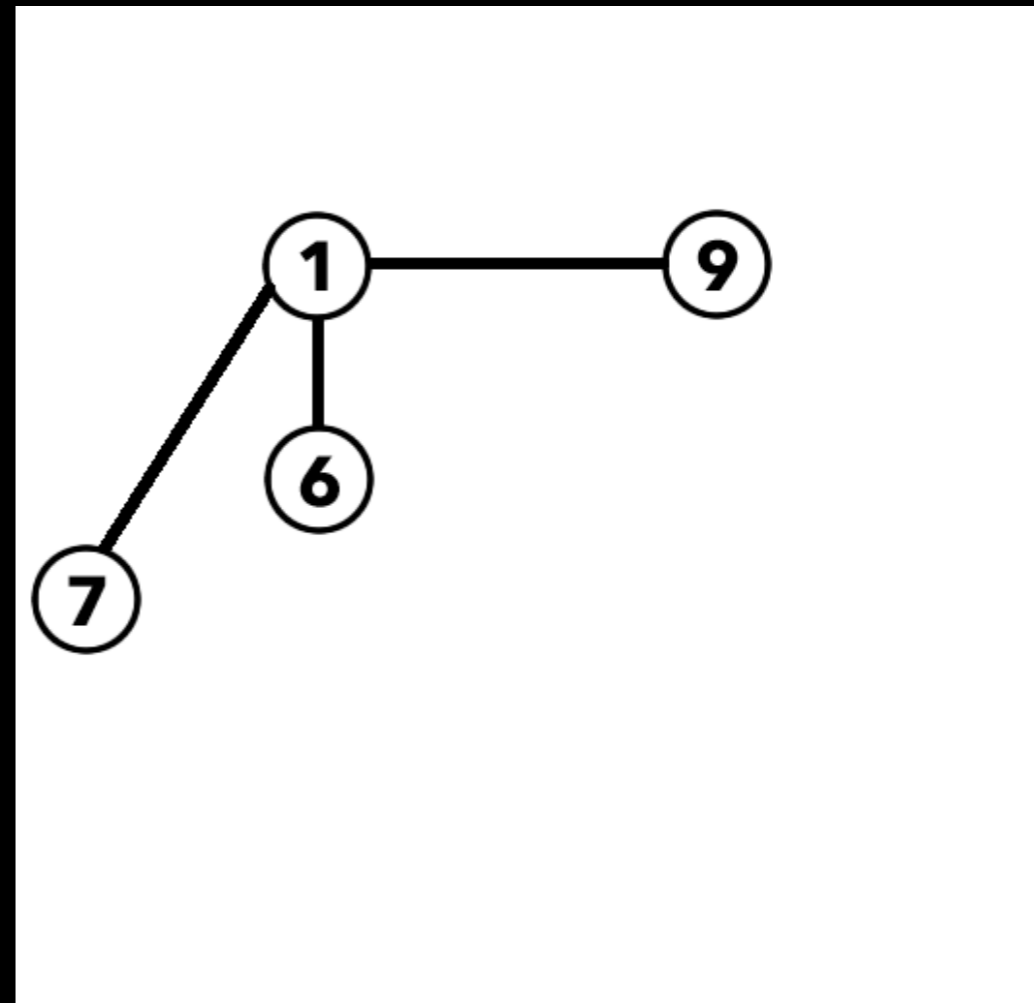
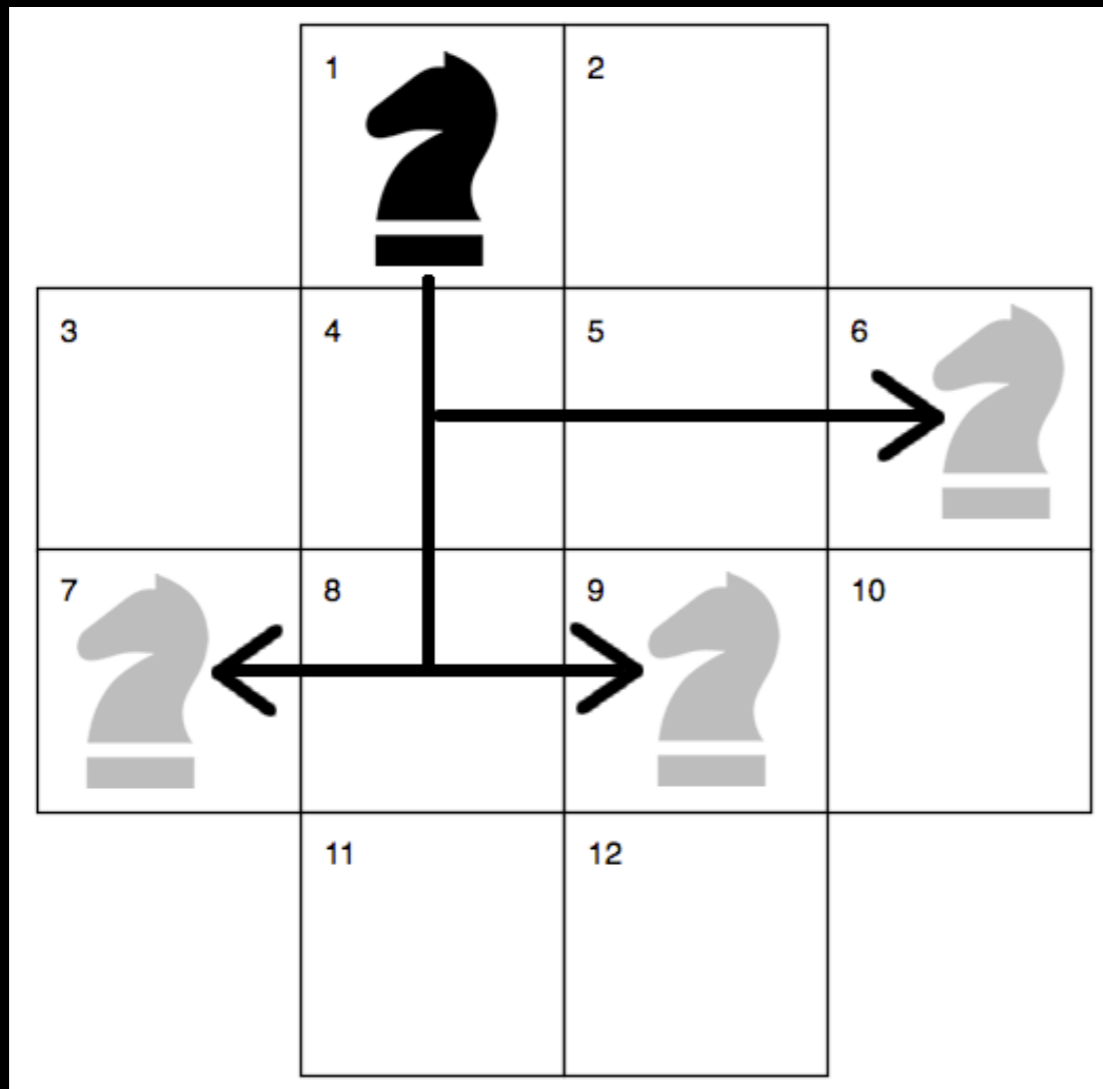
- A diagram of a system
- Made up of **nodes** and **edges**
- Can be an extremely useful way of modelling a problem



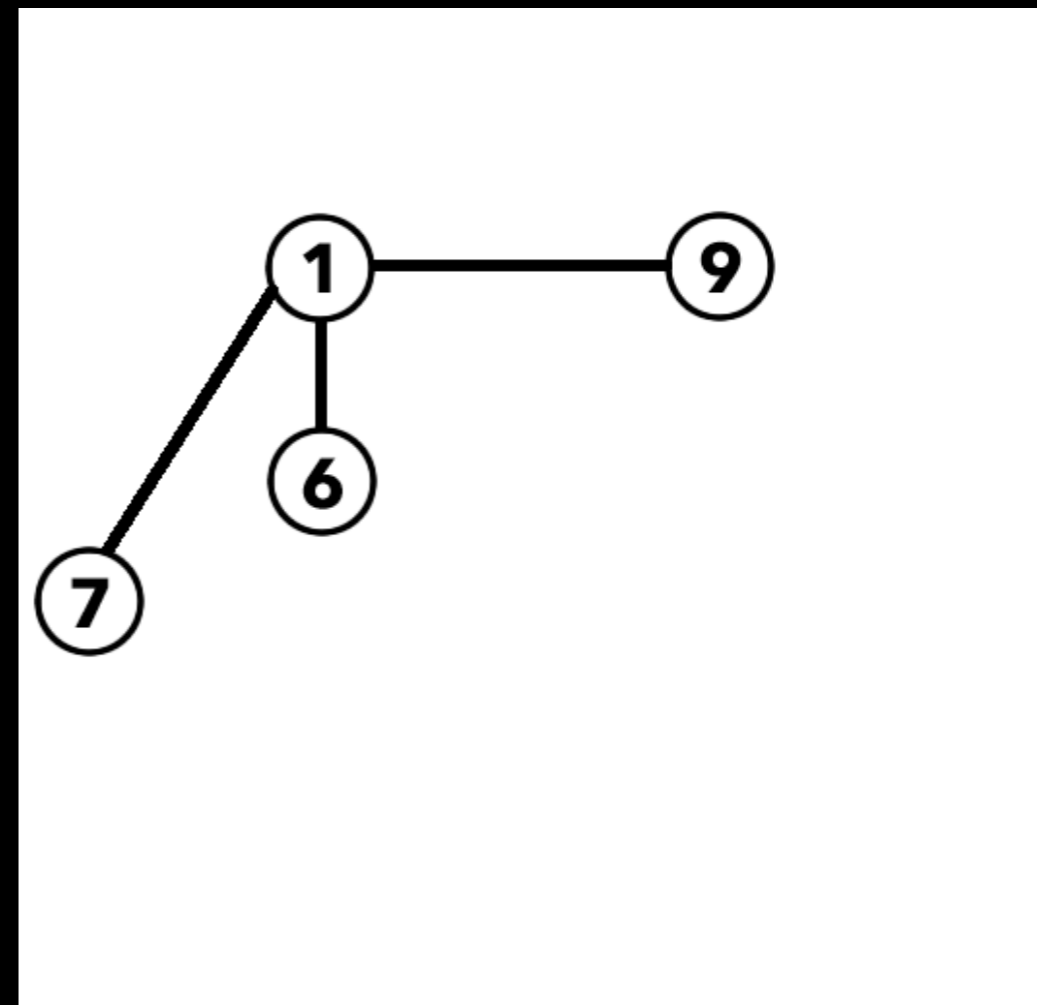
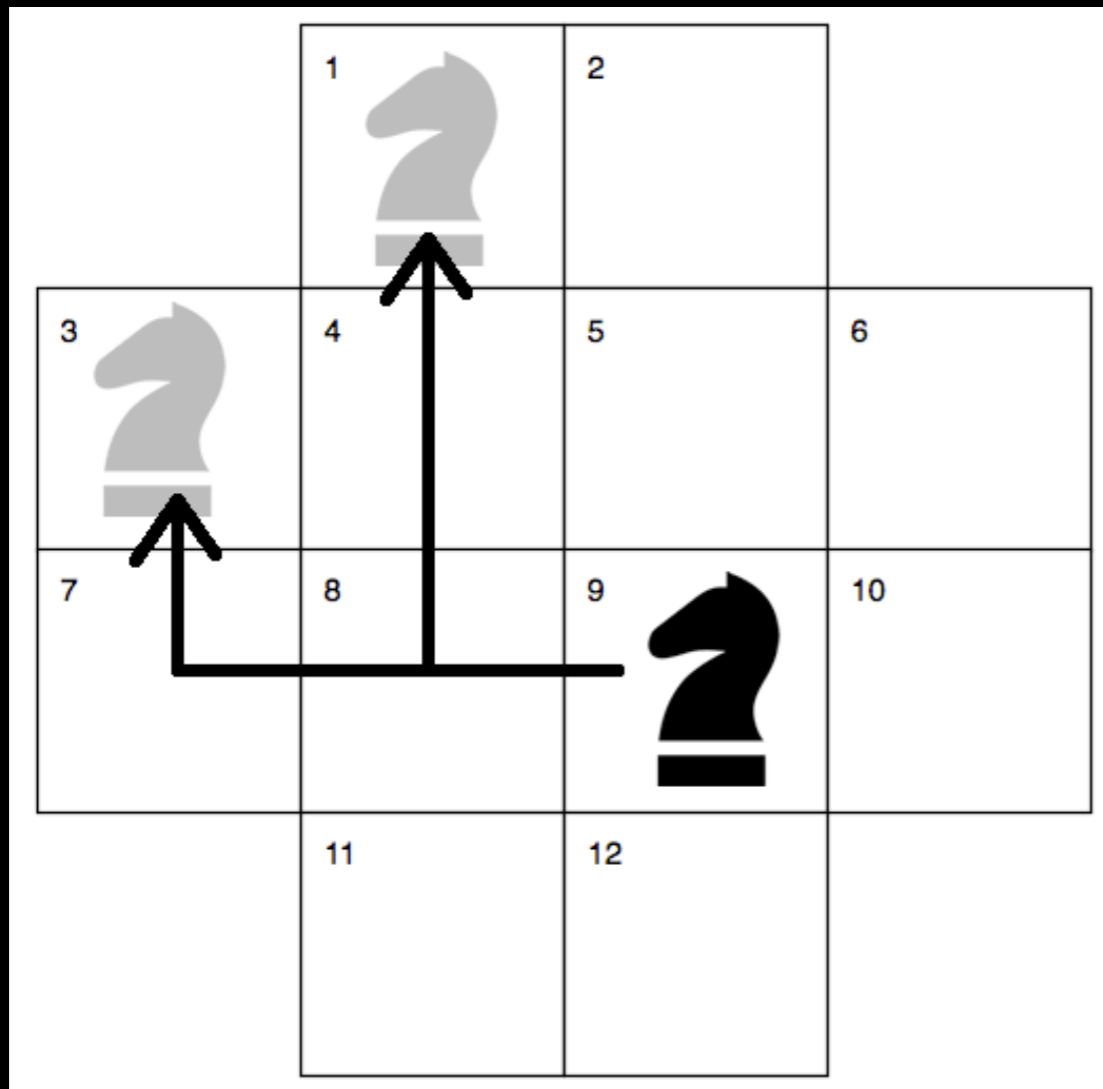
Lateral Thinking



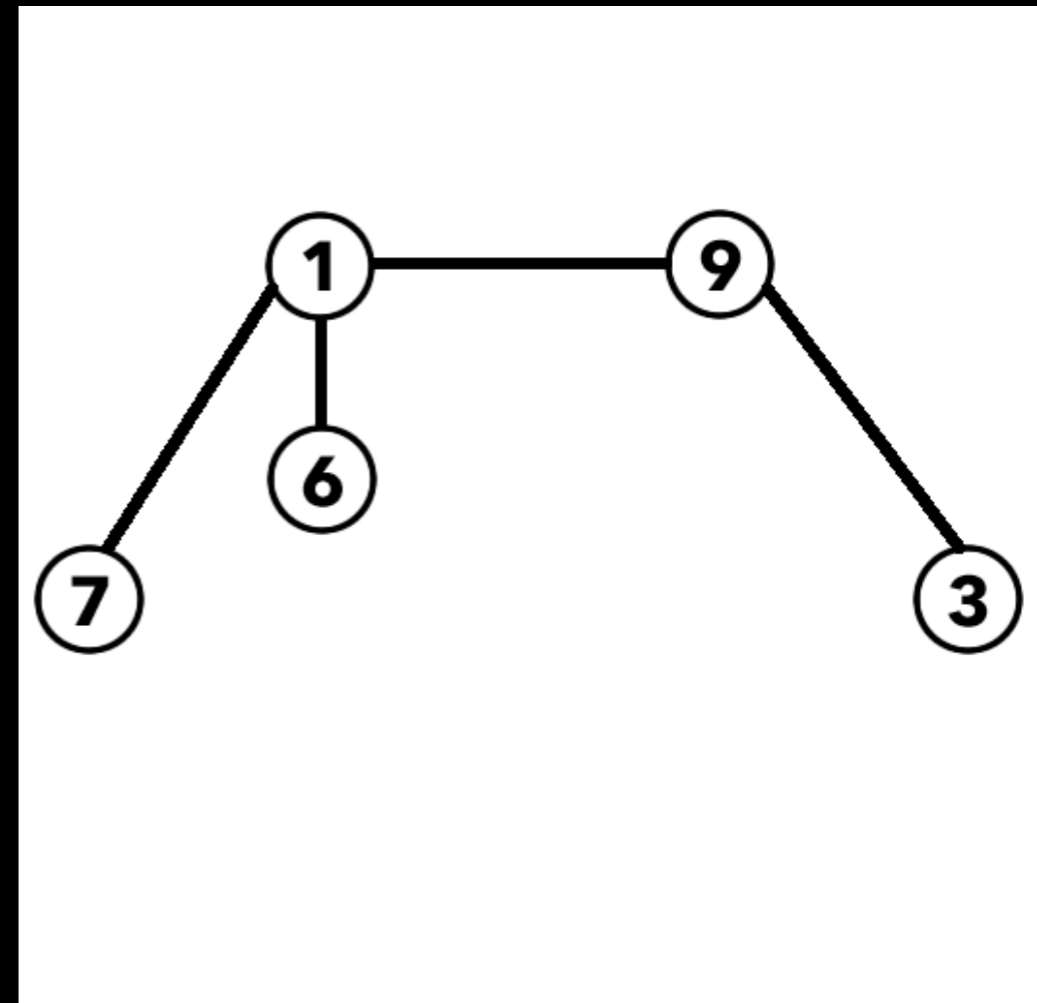
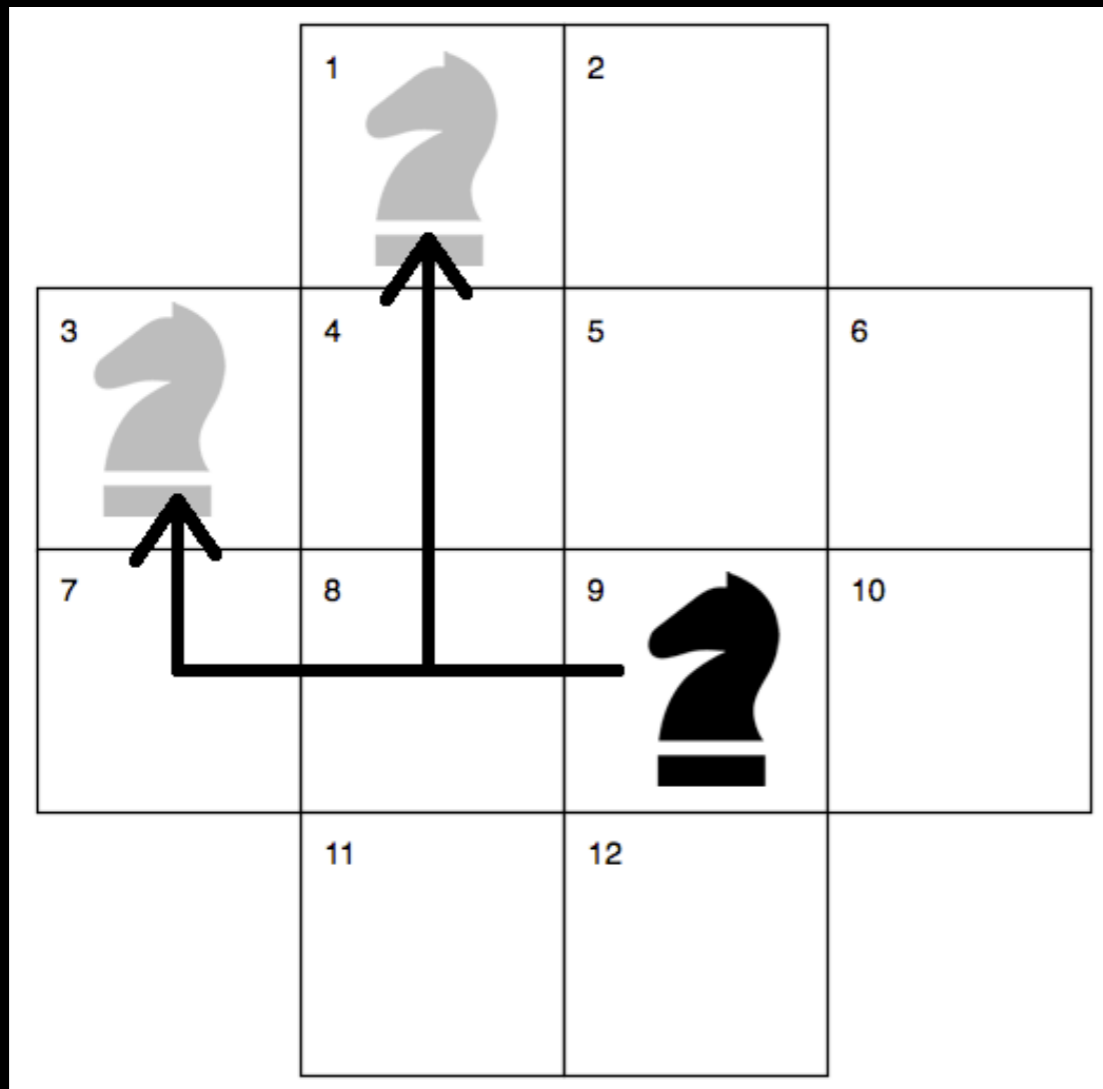
Lateral Thinking



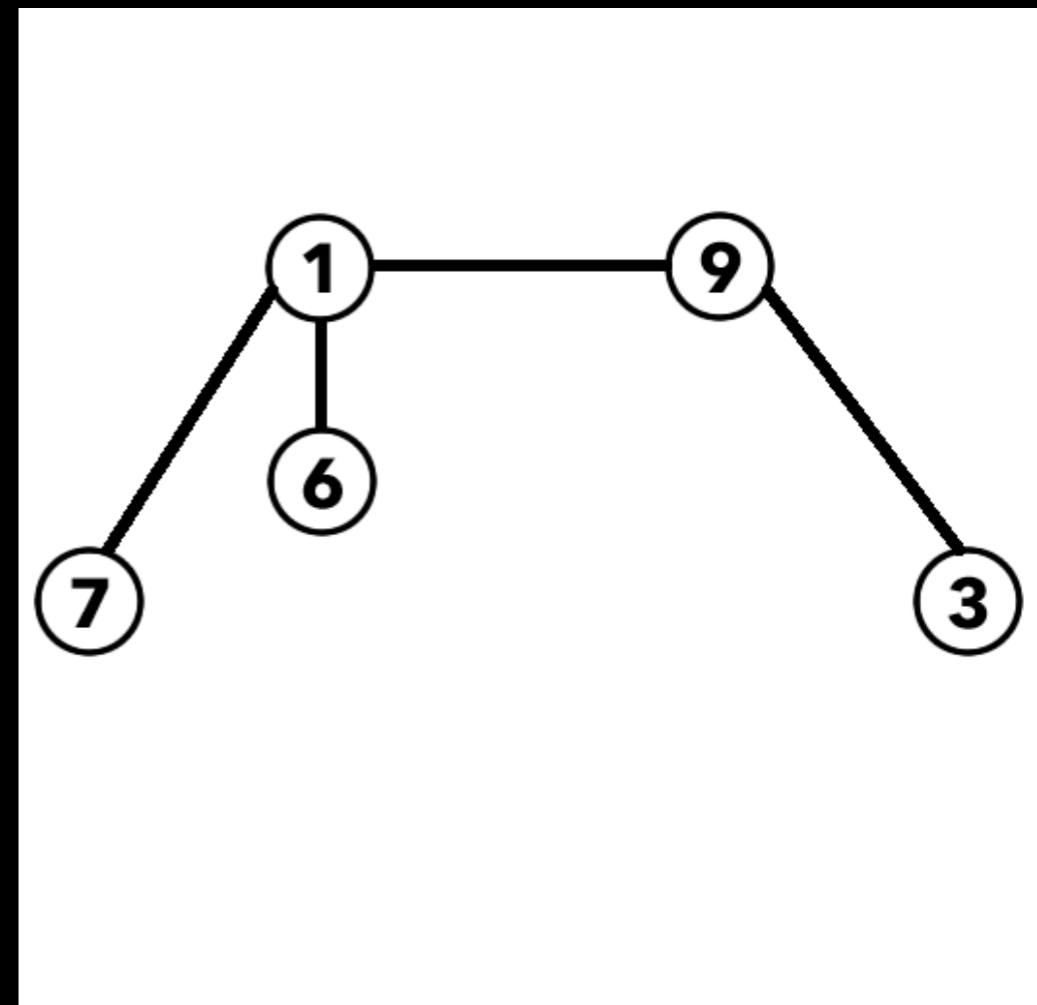
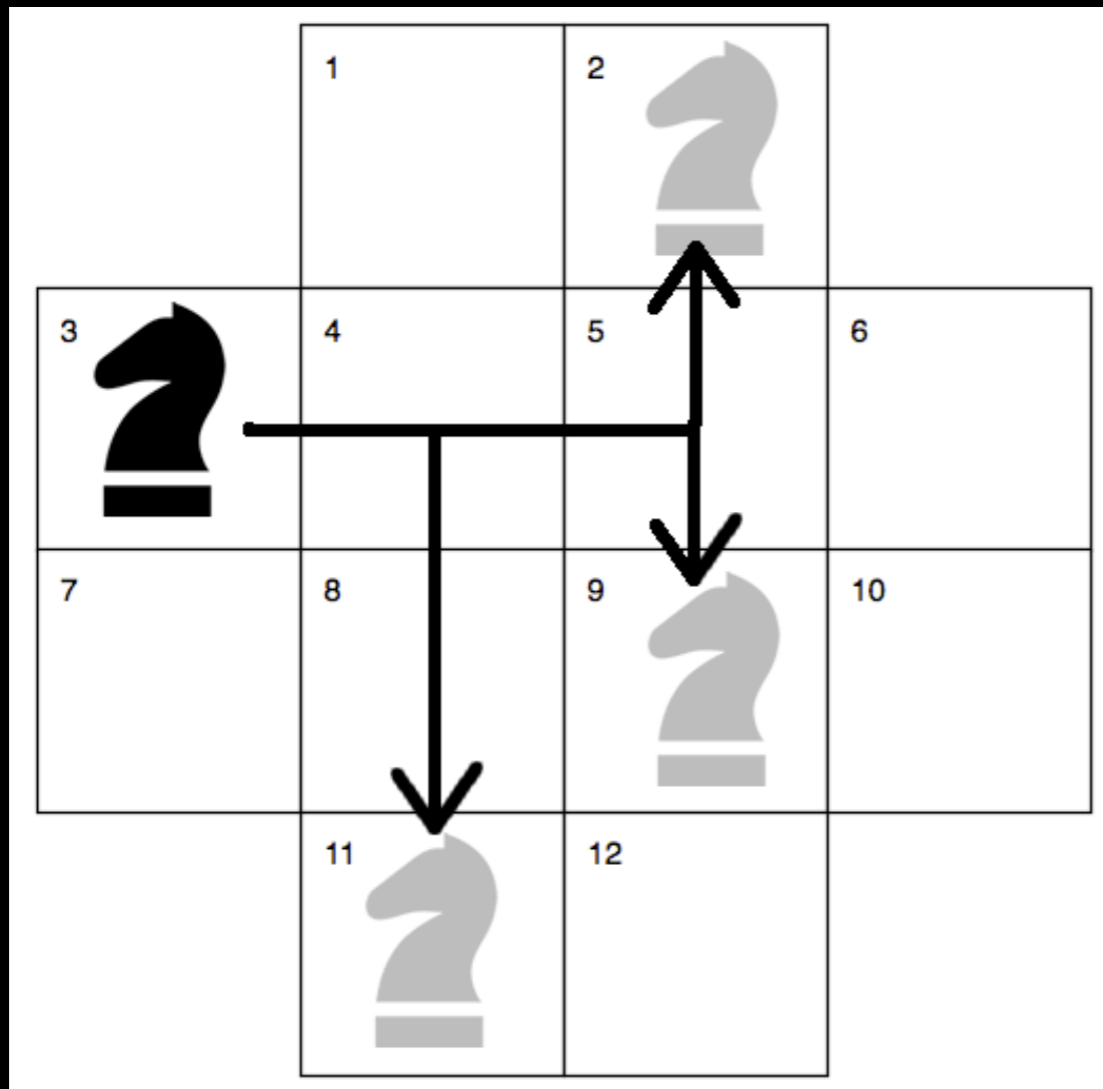
Lateral Thinking



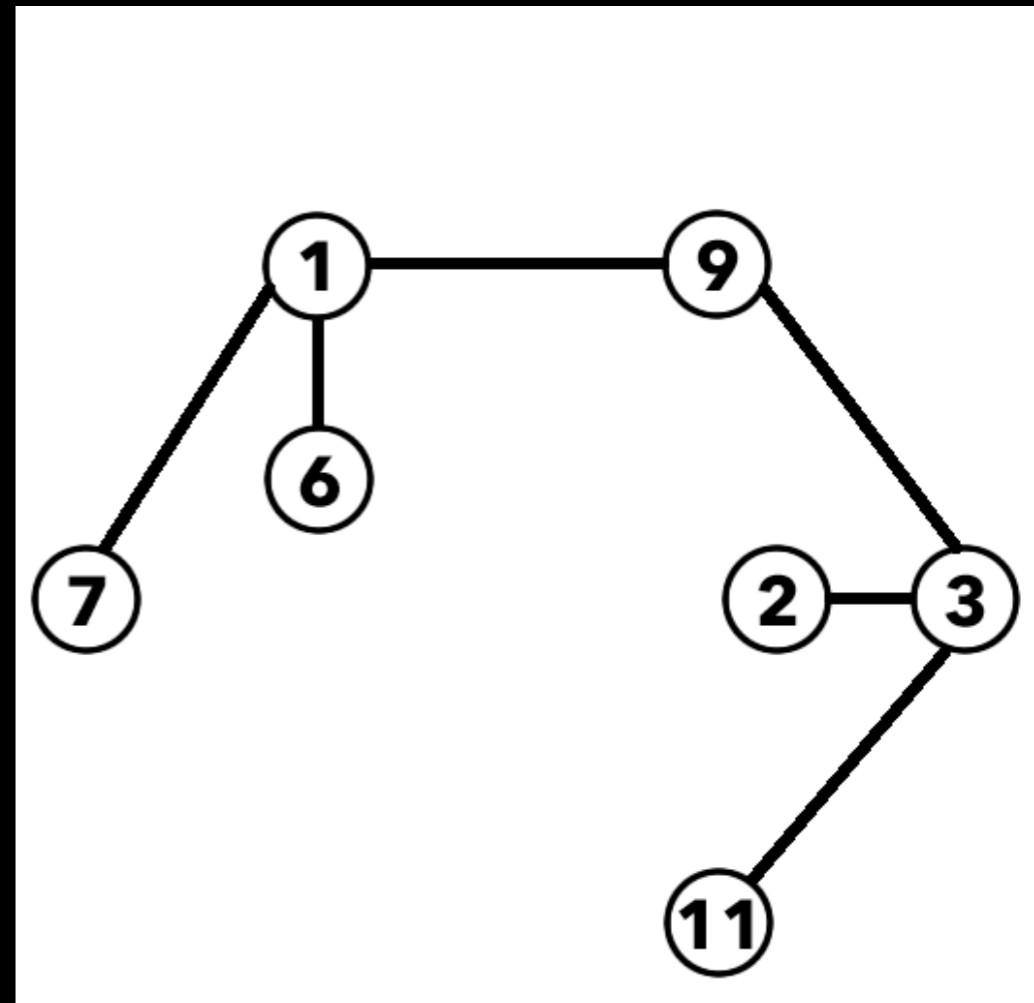
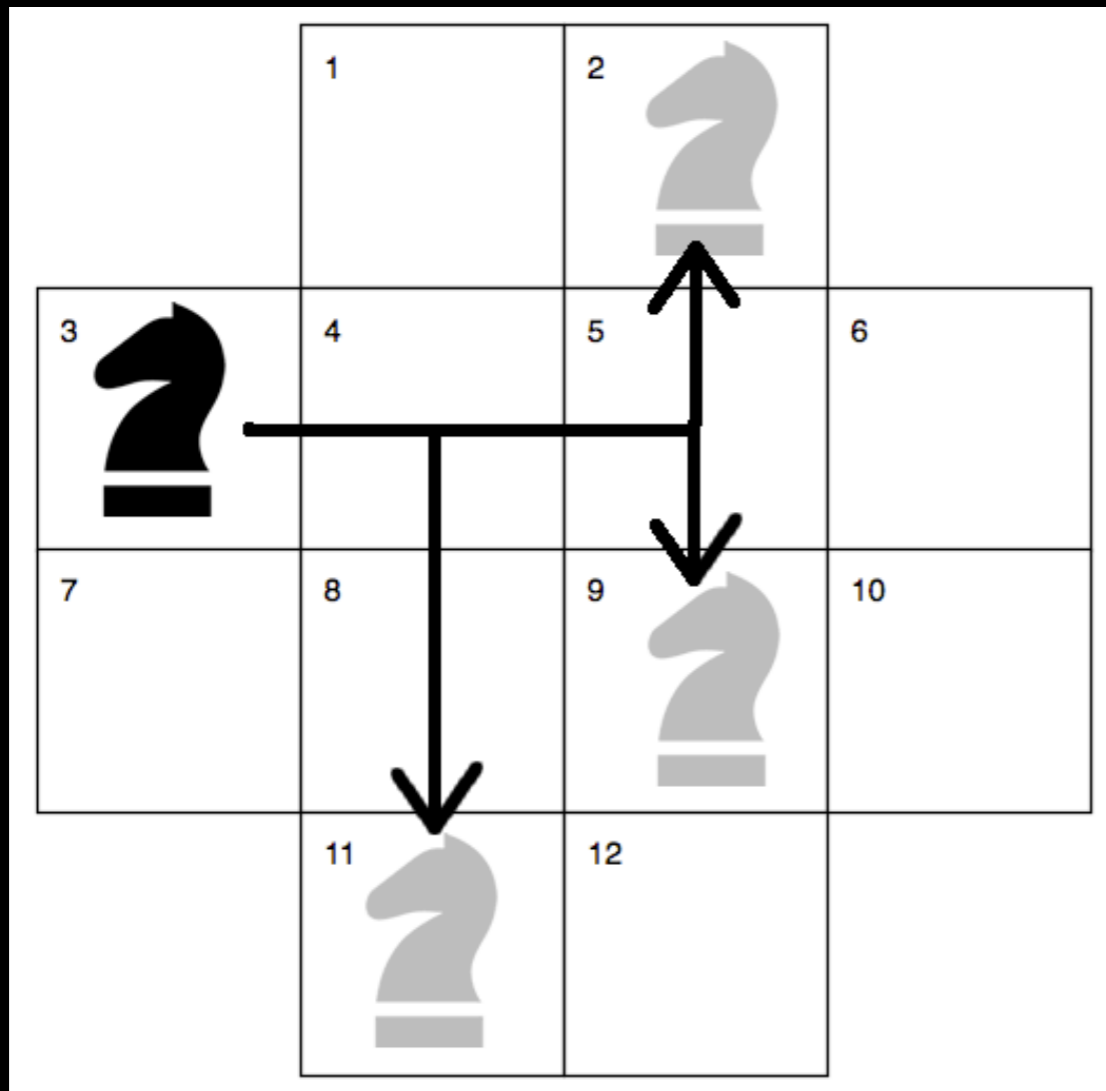
Lateral Thinking



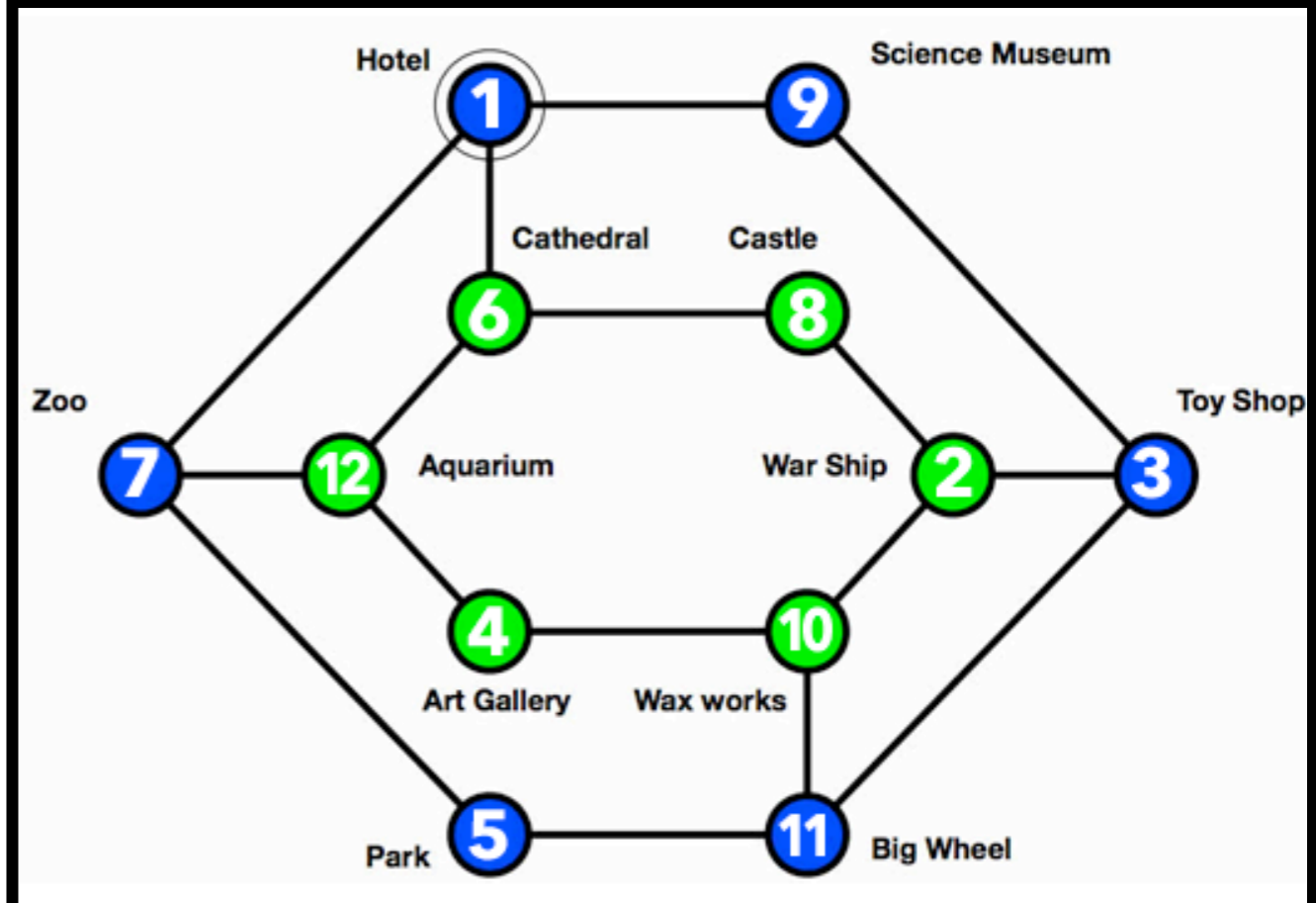
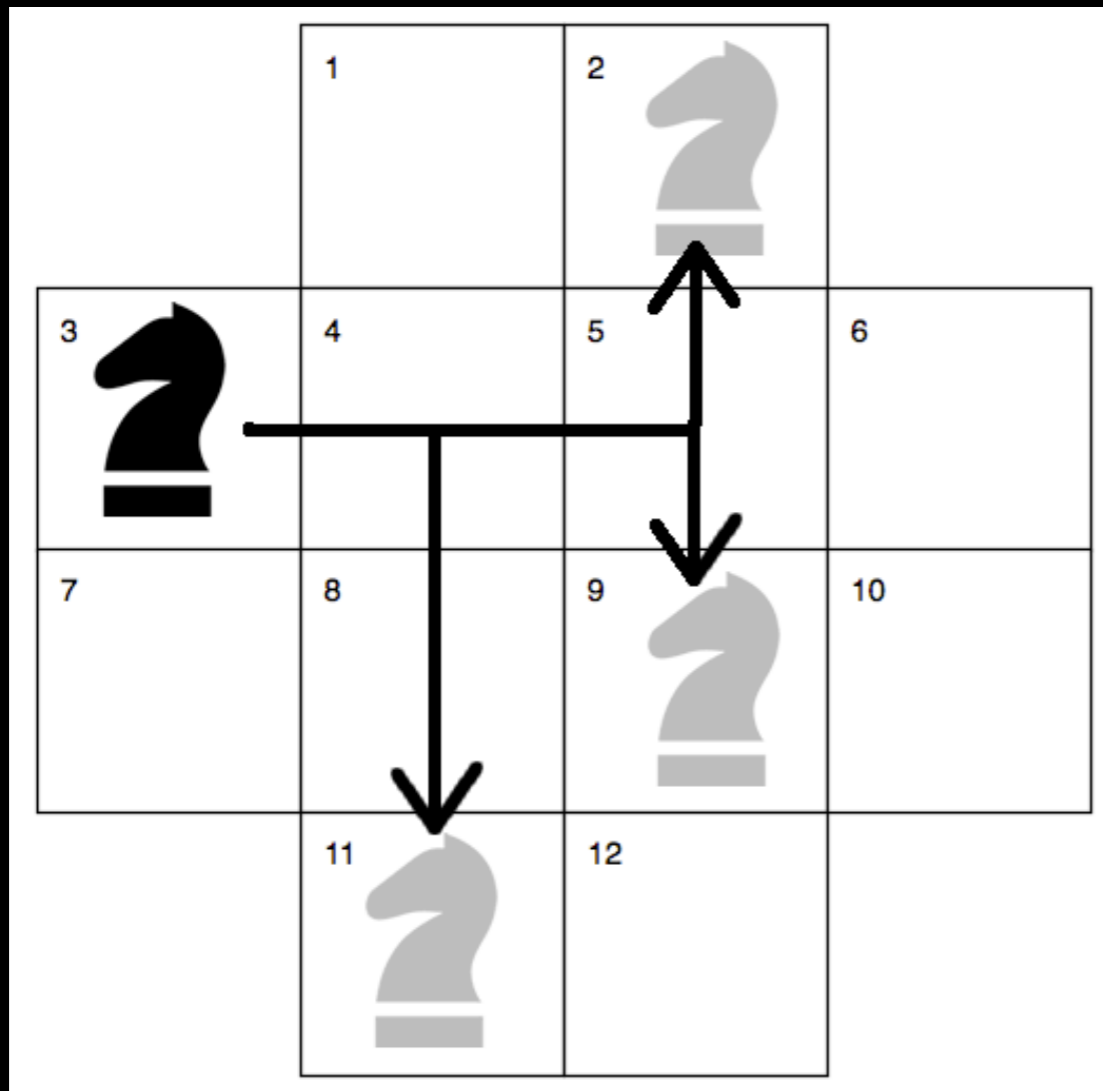
Lateral Thinking



Lateral Thinking



Lateral Thinking



Modelling

- Create a representation of a system
- Hide unnecessary data
- Reduce complexity

Modelling

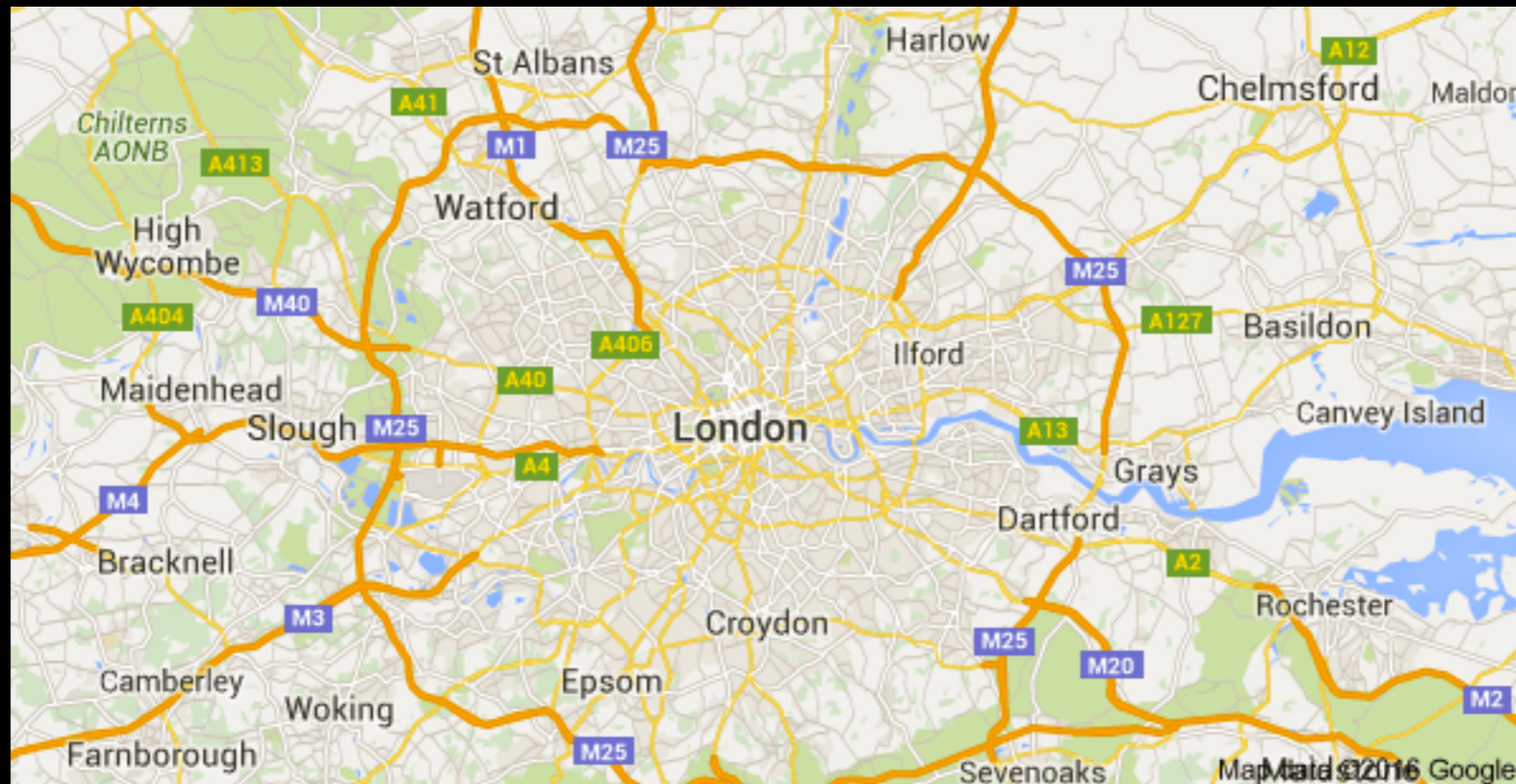
- Create a representation of a system
- Hide unnecessary data
(e.g. physical steps between moves)
- Reduce complexity
(e.g. having to jump over squares)

Generalisation

There are many interpretations of this word

- Replacing many things, with one thing
e.g. functions, mail merge
- Adapting the solution for one problem,
to solve another
- e.g. We turned Knight's Tour into a graph
- we can use the same idea elsewhere

London

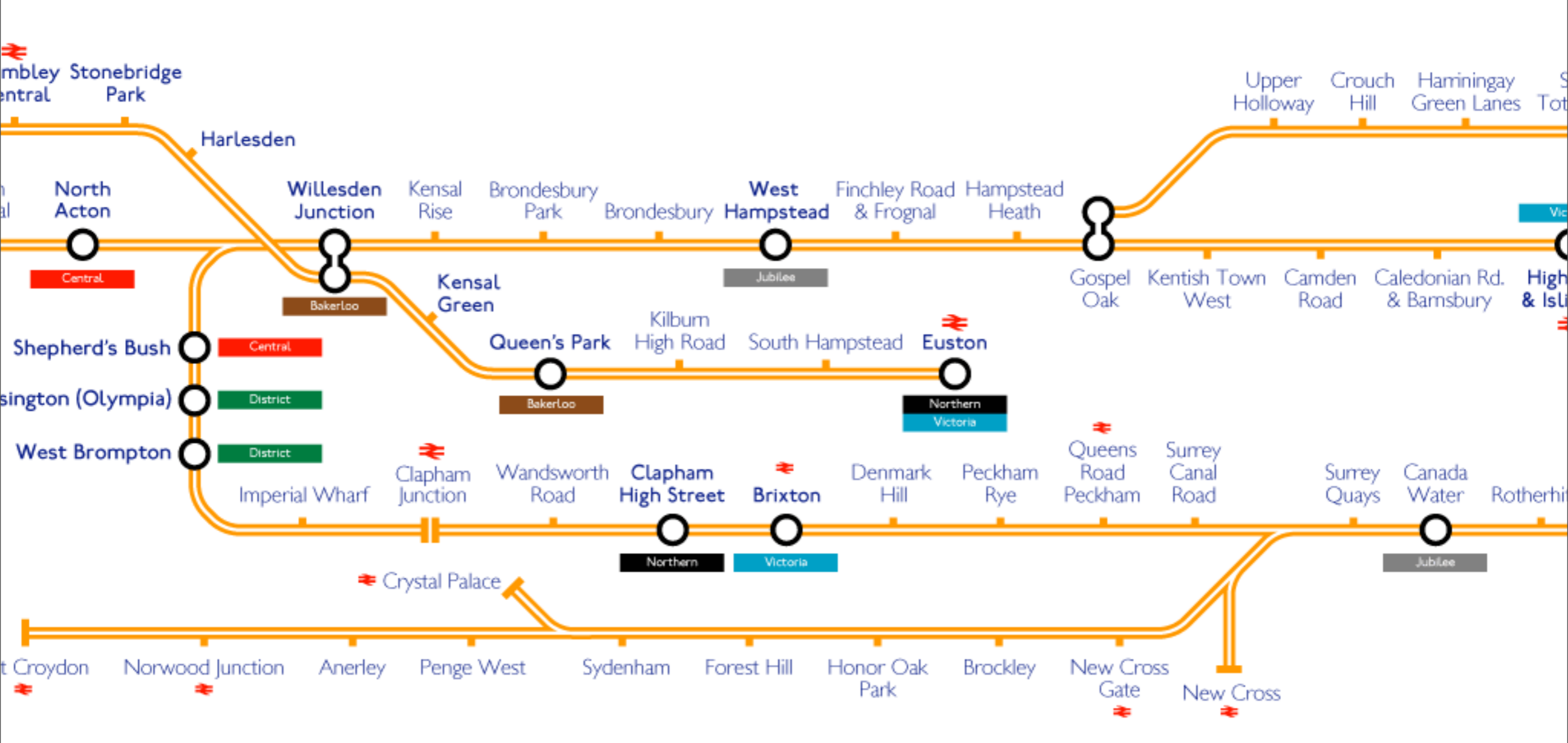


London



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London



London

Eastbound towards Barking

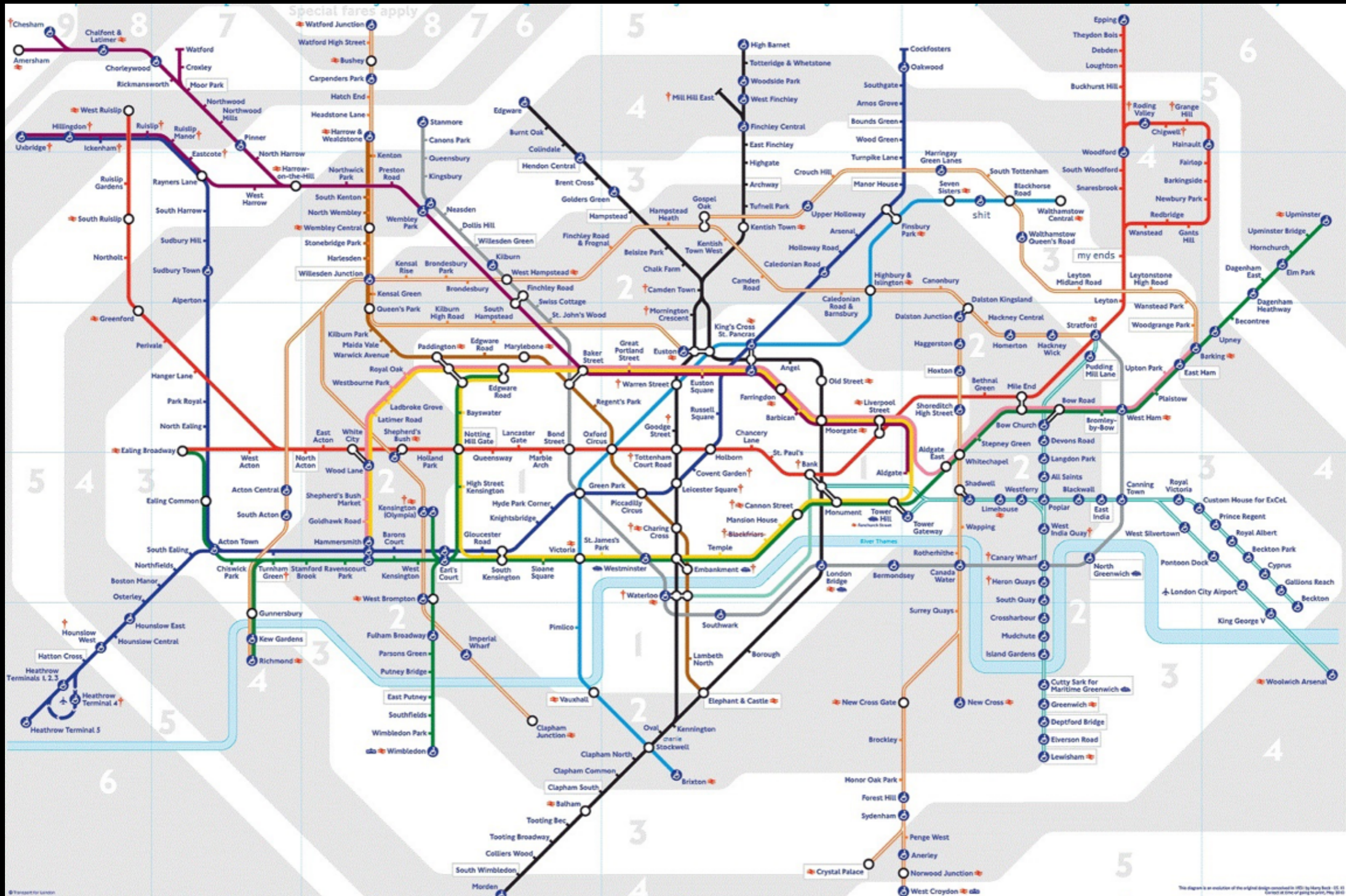
Mondays to Saturdays

Gospel Oak	0620	0635	0650	0705		2120	2135	2150	2205	2235	2305	2335
Upper Holloway	0624	0639	0654	0709	then at the same time past each hour until	2124	2139	2154	2209	2239	2309	2339
Crouch Hill	0627	0642	0657	0712		2127	2142	2157	2212	2242	2312	2342
Harringay Green Lanes	0630	0645	0700	0715		2130	2145	2200	2215	2245	2315	2345
South Tottenham	0633	0648	0703	0718		2133	2148	2203	2218	2248	2318	2348
Blackhorse Road	0636	0651	0706	0721		2136	2151	2206	2221	2251	2321	2351
Walthamstow Queen's Road	0639	0654	0709	0724		2139	2154	2209	2224	2254	2324	2354
Leyton Midland Road	0642	0657	0712	0727		2142	2157	2212	2227	2257	2327	2357
Leytonstone High Road	0645	0700	0715	0730		2145	2200	2215	2230	2300	2330	2359
Wanstead Park	0648	0703	0718	0733		2148	2203	2218	2233	2303	2333	0003
Woodgrange Park	0650	0705	0720	0735		2150	2205	2220	2235	2305	2335	0005
Barking	0657	0712	0727	0742		2155	2210	2225	2242	2310	2340	0010

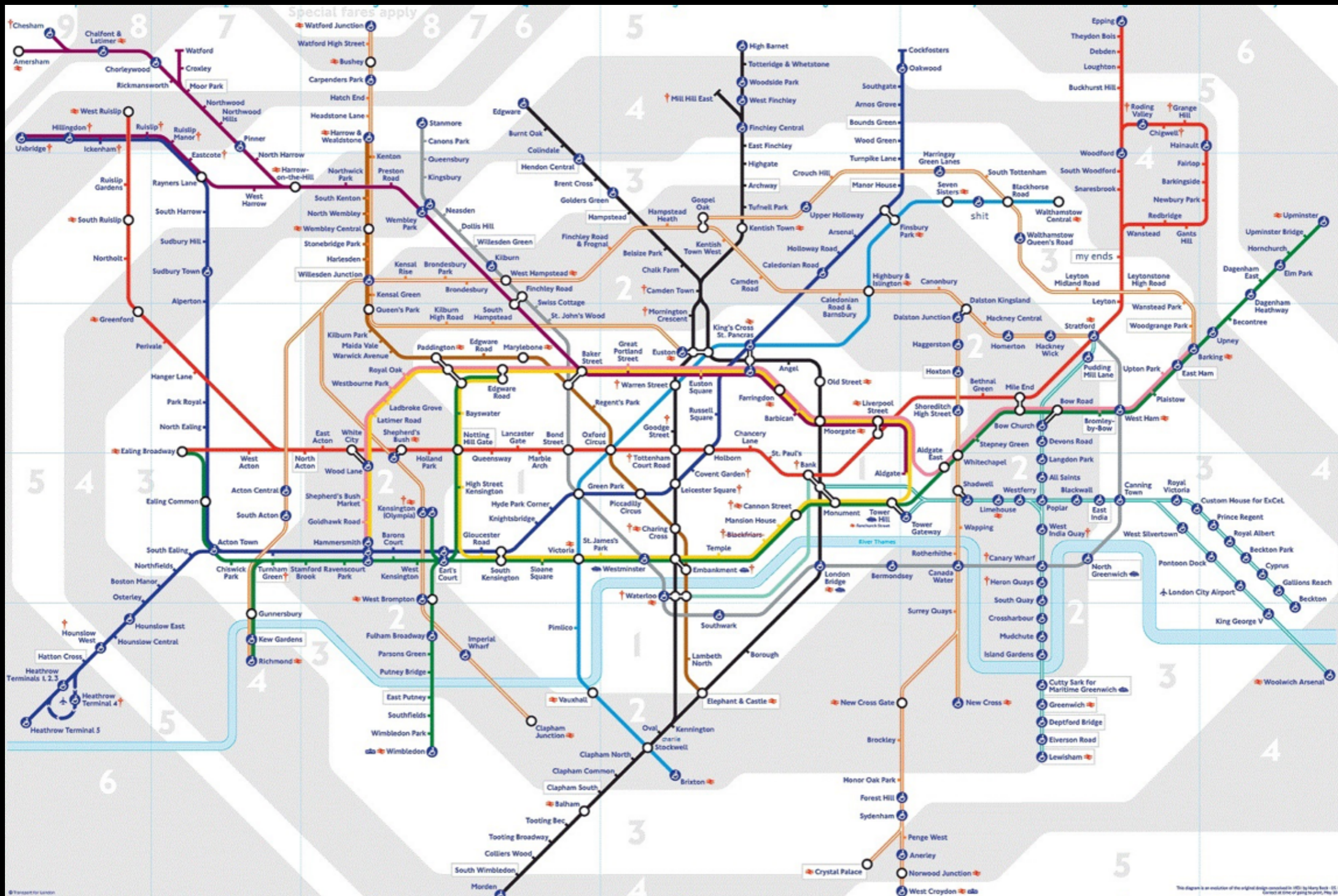
Sundays

Gospel Oak	0855	0910	0925	0940		2155	2210	2240	2310
Upper Holloway	0859	0914	0929	0944	then at the same time past each hour until	2159	2214	2244	2314
Crouch Hill	0902	0917	0932	0947		2202	2217	2247	2317
Harringay Green Lanes	0905	0920	0935	0950		2205	2220	2250	2320
South Tottenham	0908	0923	0938	0953		2208	2223	2253	2323
Blackhorse Road	0911	0926	0941	0956		2211	2226	2256	2326
Walthamstow Queen's Road	0914	0929	0944	0959		2214	2229	2259	2329
Leyton Midland Road	0917	0932	0947	1002		2217	2232	2302	2332
Leytonstone High Road	0920	0935	0950	1005		2220	2235	2305	2335
Wanstead Park	0923	0938	0953	1008		2223	2238	2308	2338
Woodgrange Park	0925	0940	0955	1010		2225	2240	2310	2340
Barking	0929	0944	0959	1014		2229	2244	2314	2344

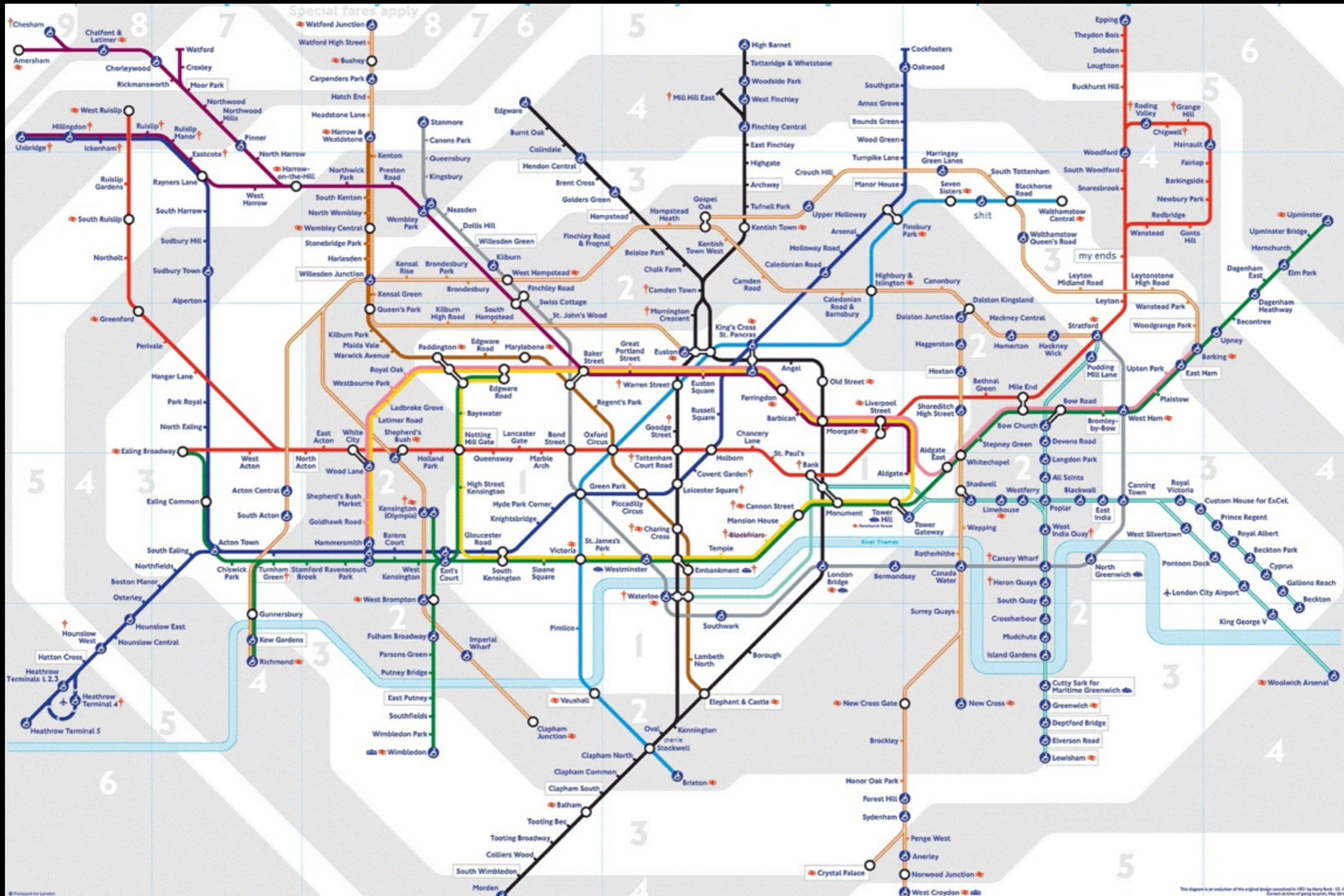
London



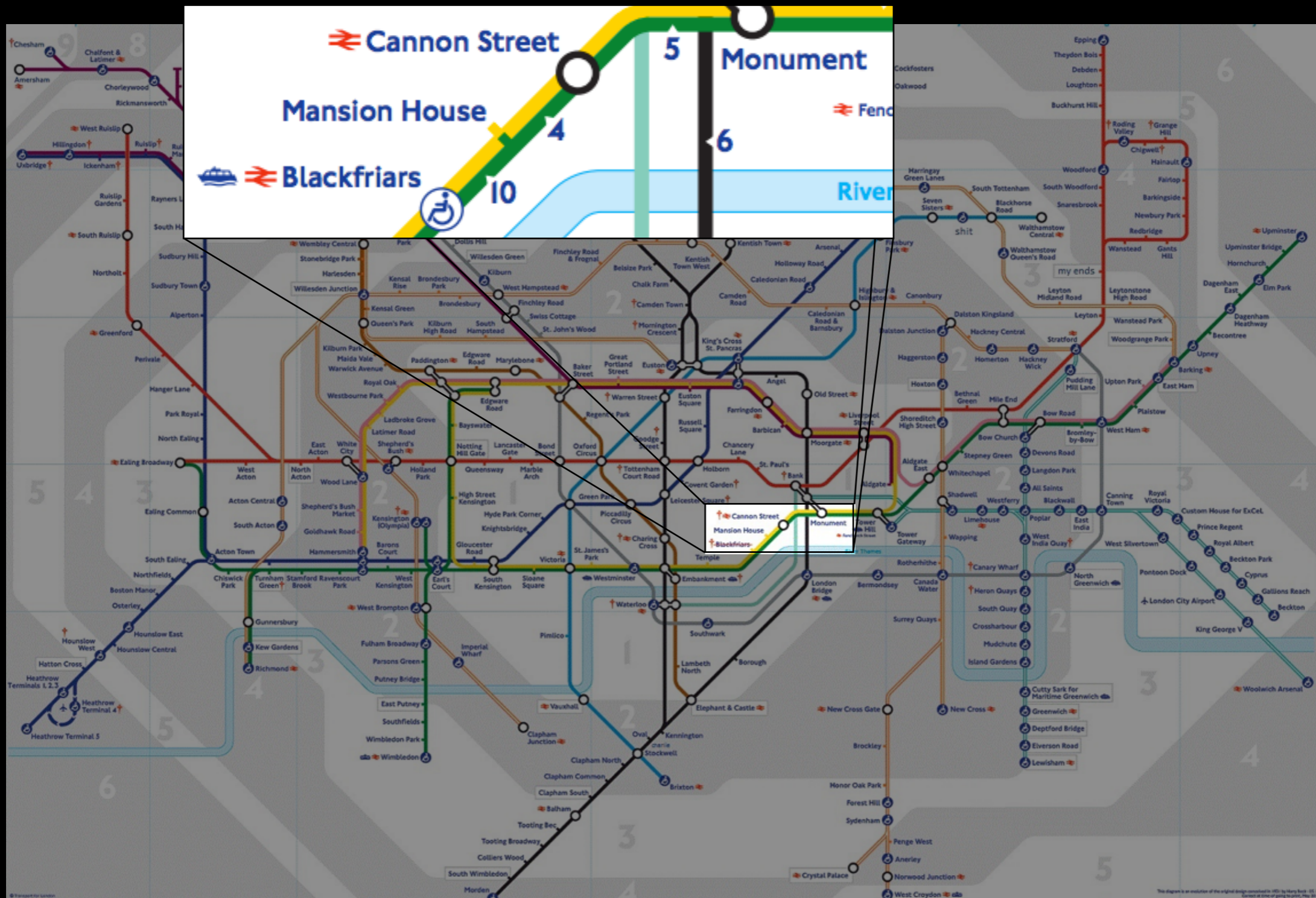
A Graph



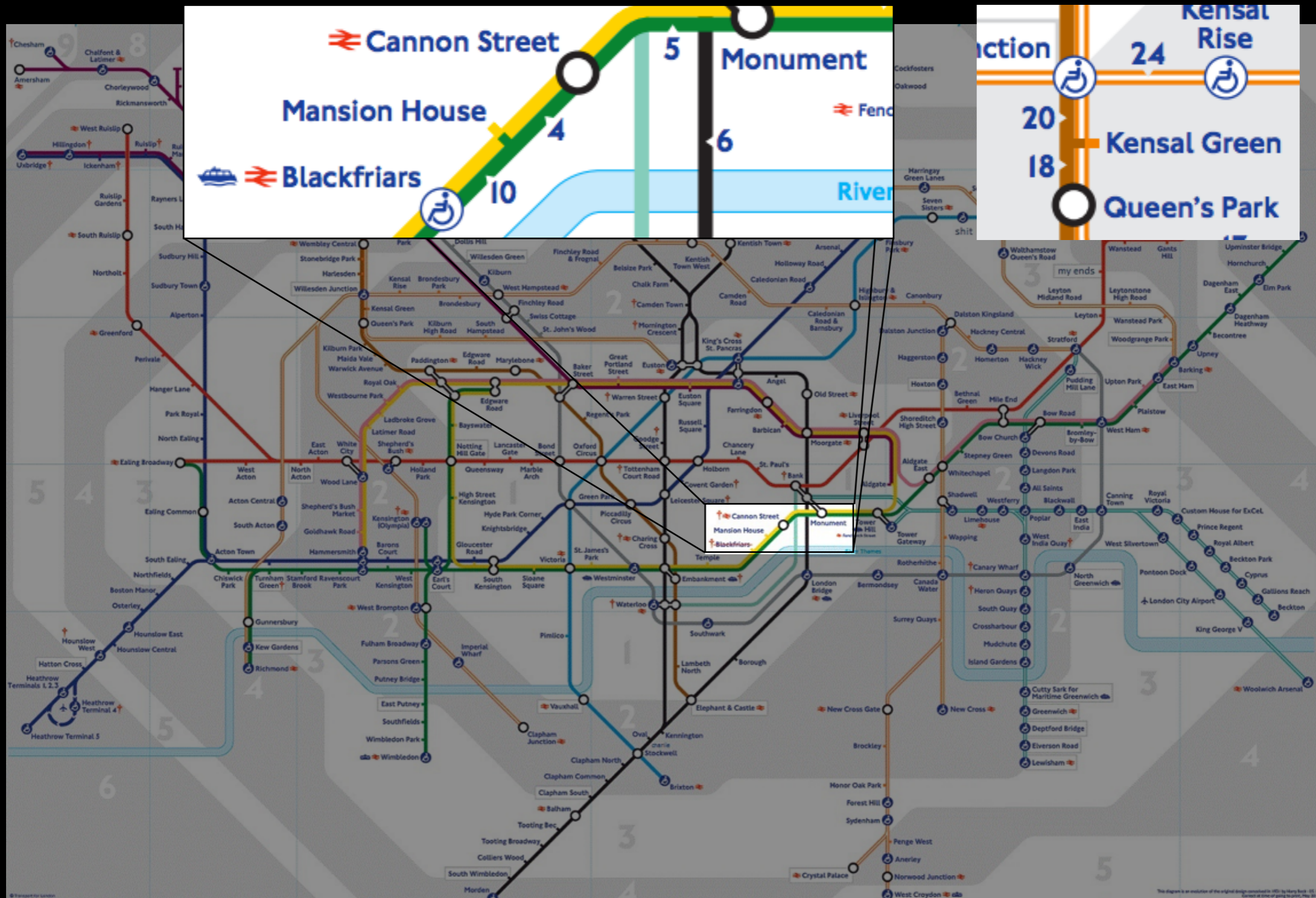
An Abstraction



Walking Times



Walking Times



Abstraction

- Modelling
e.g. creating a graph
- Decomposition
e.g. listing the steps to find the solution
- Generalisation
e.g. applying the same technique to a similar problem

Abstraction

- Modelling
- Decomposition
- Generalisation

Abstraction

- Modelling
Ignore the physical distance between stations
- Decomposition
Find the steps you need to reach your goal
- Generalisation
Use this for a different journey in London

Abstraction

- Modelling
Ignore the physical distance between stations
- Decomposition
Find the steps you need to reach your goal
- Generalisation
Use this for a different journey in London
Or in Tyne & Wear

A similar challenge

The Bridges of Königsberg

