- **Clustering coef**: measure triadic closure
  embeddedness / total
  $cc(A) = \frac{|\{(B,C) \in E : (A,B) \in E + (A,C) \in E\}|}{|\{(B,C) : (A,B) \in E + (A,C) \in E\}|}$
- **Voc**: Gatekeeper nodes, bridges (local ...), neighbourhood overlap
- **Homophily**: tend to be similar to our friends (mutable / immutable)
- **Selection / social influence** (choose friends based on similarity → become eventually more alike)
- **Affiliation network**: nodes connect focal pts of activity → more prob. to interact
- **Triadic** [same friend] **Focal** [same interest/activity] **Membership** [friend Edu]
- **A**: { each player has a set of strategies, and is **self-interested**
  - payoff matrix(func.) → everything that can be gained (even altruism)
  - players know entire struct of game

Prisoner's dilemma

	a	c
a	-1/-1	-10/0
c	0/-10	-4/-4

DOMINANT STRATEGY
LEADS TO ⊖ SOCIAL WELFARE

- **Strategy profile**: collection of all combin. $(s_{P1}, s_{P2} \ldots)$
- **Dominant strategy**: strategy that is BR for every strategy of other players.
- **Nash Equilibrium**: set of strategies such that each one is each player's BR to the other players.

Best response: strategy w/ highest payoff to other player's strategy.
Unique ⇒ **Strict Best Resp.**

		0,2
	0,2	1,1

Cycle of BRs ⇒ No NE (deterministic)

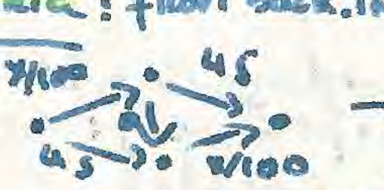
Pure Coordina. Game: Actions of players are matched to get payoff
Unbalanced Coord. Game: & pure

- **Pure strategy** vs **Mixed strategies** (1 vs [0,1] prob)
  [BR if P_2 plays s_1 w/ prob q]
  → Payoff is Randomized : **Expected payoff** (exp. payoffs for each player (strategy/profile) is now set of prob.)
  → NE is solu. of equa. of exp. payoffs for each player (strategy/profile) is now set of prob.)
  e.g. Match. pennies NE = ([0.5, 0.5]$_1$, [0.5, 0.5]$_2$)

	1	(1-q)
	s_1	s_2
s_1	A, B	C, D
s_2	E, F	G, H

- **Pareto optimality**: strategy profile such that there is no way to change the str. of one without lessening the payoff of the other
- **Social optimality**: Maximizes social welfare (sum of all payoffs)
- **Backwards induction**:
- **Extensive form games**: → conversion to normal form. ⇒ same NEs as given by Back. ind. + maybe new NE (not supported by ↓) → not credible threat

sequential equilibria: from back. ind → SE ∈ [NE], NE ∉ [SE] (NE comes from matrix)



- **Braess' Paradox** → Unique NE (Dominant str. for all players ⇒ to take new route)
- **Auctions**:
  - multi-item: 1 seller + multiple items
  - procurement (reverse) auction: 1 buyer + multi sellers
  - double-sided auction: multi - all → matching
  - ascending bid (English)
  - descending bid (Dutch)
  - sealed bid → 1st price (FPS) → 2nd price

1st price shading
payoff function:
$g(v) = v(v_k - s(v))$
diffeq. true value → v_k, prob of winning → $s(v)$
$\Rightarrow s(v) = \frac{v}{2}$

If everyone follows same str. (↗) ⇒ similar to Dutch

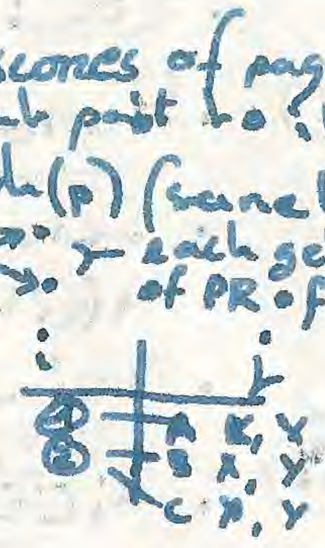
- **Winner's curse**, (Loser's curse)

- indep. private value
  - Bidding true value is DS (Dominant Str.)
  - max (social welfare)
  - surplus is divided between buyer/seller
  - similar to English Auc.

- complement: item price ↑ when combined ↓ substitute
- navigat°l links, transact°l links
- (WOC) bow-tie (IN, SCC, OUT), tendrils, tubes, disconnected comp.
- info retrieval (IR): query → list relevant
- **Hubs & Authorities**: . Auth. update rule: auth(p) = Σ hub scores of pages that point to it
  . Normalize: divide auth(p) by Σ auth(p) (same hub) / sub(p)
- **Page Rank**:
  . Basic rule: assign 1/n to all then A → ... → each gets ½ of PR of A
  . Scaled rule: ... → each gets (1-s) PR / n

(KE)

- **VCG**: $p_{ij} = \underbrace{V^{S}_{B-j}}_{\Sigma \text{ prices } B \text{ pays for he's item}} - \underbrace{V^{S-i}_{B-j}}_{\text{in the case where A and @ are not included}}$ (price j pays for i)



- **GSP**: bidder i gets ith item for price 2nd highest bidder
- **Matching Markets**: . one-sided - only buyers sellers have pref.
  . two-sided - both sides have preferences
- **Constricted set**: ✂ (⇔ matching theorem)
- **Ranking / Valuation models** (p1 > p2 ... vs 1, 2, 0 ...)
- **Preferred seller graph**: after increasing prices to break constricted sets
- **Market clearing**: . same as requiring perfect matching in PSG
  . existence and all have same TP (all max(SW))
- **Gale - Shapley algo**: . FPDA / MPDA (FPDA → optimizes social welfare for buyers → minimizes ↑ SW
  . opt(w) = w in FPDA male-pessim)

- Informations effects: choice of others yield information ||
  Direct Benefit effects: same technology

cluster density: set of nodes such that each node in the set has at least a fraction p (clus. dens.) of its network neighbours in the set

<d> threshold = no spread (threshold $q = \frac{k}{a+b}$) → (pda > (1-p)db) → payoffs

SIR: susceptible infections removed SIS: susceptible inf. susc.

Ring network: Random long-range links (spread dep. prob Gauss form)

Sing. parent ancestry model: total pop N at some pt in time tot is down to k lineages. to see if lineages collide, track one to some parent in, otherwise have to be tracked down to same parent in (k-1) nodes [prob ½=3, otherwise no collapsing. $1 - \frac{k(k-1)}{2n}$

- **Completeness**: A>B>C (A≯B) **transitivity**: avoid cyclicity

Plurality / Majority, **Borda** (A>B>C: 2, 1, 0), **Approval** (Ⓐ>B>C ×5 : A=5; Ⓐ>Ⓑ>C ×3 : A=3, B=3)

Single Transferable Vote: eliminate lowest candidate (plurality) at each round

- **Condorcet Principle**: Rule is condorcet-consistent if it selects condorcet winner (if ∃): winner in all pairwise maj. votes.
  . **Condorcet paradox**: cycles

Weak monotonicity: if A wins in a subset ABSCSD, if people 'promote' A he should still win. (STV violates WM)

Indep. of Irrelevant Alternatives: if 2 candidates maintain their relative position, the outcome should be the same

Unanimity (WeakPareto): (A is better / A>B always B cannot win)

Non-dictatorial, **Anonymity** (everyone is =), **Neutrality** (choices don't have weights)

- **Arrow's theorem**: No voting rule satisfies IIA, non-dict & unanimity
  Median Voting: (Single peaked: ⋀) → no strat. proof, condorcet consistent (no add) Pareto efficient (no other choice is better for all)
  May's theorem: Plurality is the only one that satisfies anonymity, neutrality, ↑ respons.