Lec 4/6

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Recall: $FIN = \{e : W_e \text{ is finite}\} \in \Sigma_2$.

Now $CO-FIN = \{e : \overline{W_e} \text{ is finite}\}$

$= \{e : \exists n \forall m \exists s \ (m > n \Rightarrow M_e^s(m)\downarrow)\} \in \Sigma_3$

$REC = \{e : W_e \text{ is recursive}\}$

This is wrong: → $= \{e : \forall n \exists s \ [M_e(n) \text{ halts in fewer than } s \text{ steps}]\} \in \Pi_2$

$W_e \not\Rightarrow M_e$ halts on all inputs.

↓

$= \{e : \exists i \ \forall x \ \exists s \ [M_i^s(x) \text{ halts } \& \ M_i^s(x)\downarrow \iff M_e^s(x)\downarrow]\} \in \Sigma_2$

$K' = \{e : \Phi_e^K(e)\downarrow\}$ first, $K = \{e : M_e(e)\downarrow\} = \{e : \exists s \ M_e^s(e)\downarrow\}$

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$= \{e : \exists \langle s, s', \sigma \rangle \ \forall \tau < \sigma \ [M_e^{s'}(e)\downarrow$ or

$= \{e : \exists \langle s, \sigma \rangle \ [\sigma \subset \chi_K \text{ and } M_{e,s}^{\sigma}(e)\downarrow]\}$

$\sigma \subset \chi_K \iff \exists \hat{s} \ \forall 1 \le i \le |\sigma| \ [\sigma_i = 1 \Rightarrow M_{i,\hat{s}}(i)\downarrow]$ and

$\forall t \ \forall 1 \le i \le |\sigma| \ [\sigma_i = 0 \Rightarrow M_{i,t}(i)\uparrow]$

$INCOMP = \{\langle a, b \rangle : W_a \text{ and } W_b \text{ are turing-incomparable}\}$